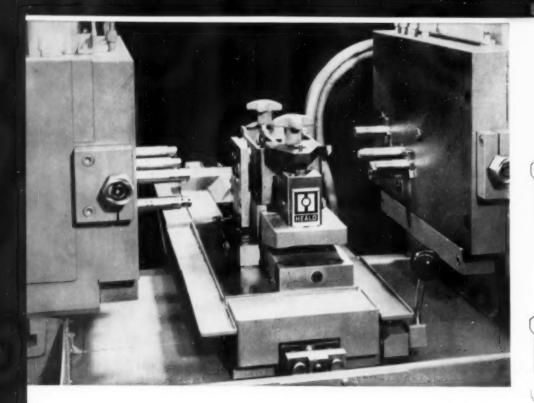
# Tool Engineer

OCTOBER 1957

balancing a miniature part

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS





# MULTIPLE HOLES ON CLOSE CENTERS

### in one fully-automatic cycle!

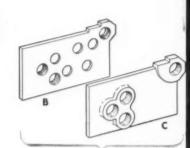
New Multi-Spindle Boringheads make it as easy as A, B, C

PRECISION boring of closely-spaced multiple holes used to be a slow and laborious job — done one-at-a-time on large, costly equipment that required highly-skilled operators. But not any more!

The new Heald Multi-Spindle Boringheads put high-precision, close-center borizing on a mass-production basis. Used with any Heald Bore-Matic, this Multi-Spindle head will precision Borize any practical number of holes, on centers as close as ¾", at a single pass of the table — and duplicate the same operation again and again. A Multi-Spindle head unit consists of a supporting frame which mounts interchangeable spindle plates, precision bored to receive the required number and arrangement of miniature precision Red-Head boringheads.

Any or all boringheads, including the smallest size, <sup>3</sup>/<sub>4</sub>", can be provided with hydraulic cross-feed units operated from a single cylinder. Job changeover is simply a matter of switching spindle plates, and mounting the miniature boringheads required.

For the complete story on this important new development, send for Bulletin 2-021-022-1 Issue 1.



Holes Borized on Left End

Holes Borized on Right End

#### HERE'S A GOOD EXAMPLE:

The Model 122 Bore-Matic shown above is equipped with Multi-Spindle Boringheads on both ends, to precision finish closecenter bores in a small transmission housing. Each head consists of a group of miniature, precision Red-Head boringheads mounted on spindle plates that are jig bored for precise location of each Red Head. The setup shown, with 5 heads on the left and 4 on the right, is designed to bore and face 17 different holes. All operations are performed in a single, fully automatic cycle, with just one chucking of the work, and no indexing. The surfaces finished at

each end of the machine are shown in the "exploded" part drawings above.

IT PAYS TO COME TO HEALD

### THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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COVER: Watch balance wheels require several dozen precision operations. The final operation—balancing—is accomplished by drilling small amounts of metal from screws located on the periphery of the wheel. Other operations in miniature parts manufacture are described in an article beginning on page 86.



## The Tool Engineer

Volume XXXIX, No. 4

October 1957

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PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

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### THE TOOL ENGINEER

Editorial & Business Offices 10700 Puritan Ave. Detroit 38, Mich.

> Publication Office: 239 E. Chicago St. Milwaukee, Wis.

THE TOOL ENGINEER is published monthly in the interest of members of the American Society of Tool Engineers. Entered as second class matter, November 4, 1947, at the post office at Missakee, Wisconsin, under the Act of March 3, 1879. Yearly subscription: members 82,00; nonmembers, 86,00; Canada, \$6.50, and all other countries, \$8.00. Copyright 1957, American Society of Tool Engineers.





### Modernize or Suffer

LONDON—Automation is also a magic word in England. It awes the public with a mysterious, ultramodern aspect. Some British industries have capitalized effectively upon the word and have gained public acceptance. Some, however, have not developed new ways but are content to maintain status quo. They don't seem to realize that is impossible.

Manufacturers employing old methods or equipment feel that competition has been unkind or that customers have ceased to be discriminating and appreciative of a quality product.

If a plant, however, is employing modern methods of production and is constantly working on improving its product, it is probably experiencing prosperity. Modernizing is a philosophy, a state of mind that recognizes change as inevitable and progress as essential to success.

A company doing a better job has expanding markets for its product. It is growing larger and has an increased work force. The skills required of the worker in such a plant are also changing. Companies, recognizing their responsibilities, are anxious to train the employee properly. All that is required is cooperation and mutual understanding.

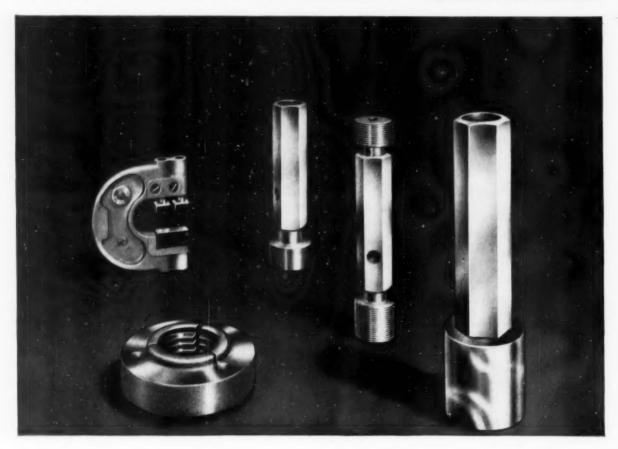
Upgrading eliminates some and minimizes other disadvantages of the machine age. Many repetitive and monotonous tasks are eliminated. Brute strength is replaced by mechanical power. The increased production and quality of product resulting from employee effort reflects in more pleasant work and a higher standard of living for his family.

. These facts have been demonstrated repeatedly since the industrial revolution. They have also been shown to be as true with the modern version of mechanization called automation. Examples of these facts are easily seen by the casual, outside observer.

The tool engineer assists in employee rehabilitation. He pinpoints the necessity for modernization, both here and in North America. By developing better production methods and influencing management to adopt them, he is the vital factor on the industrial team that prevents stagnation.

John W Grave

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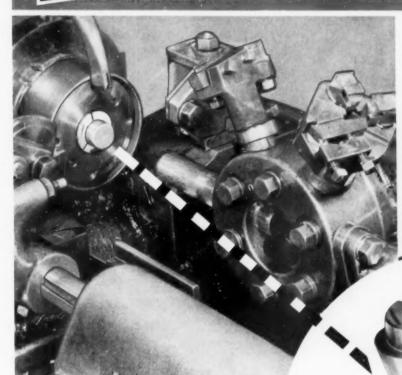


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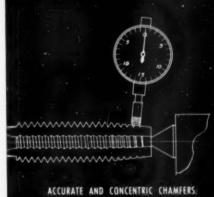
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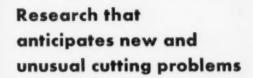




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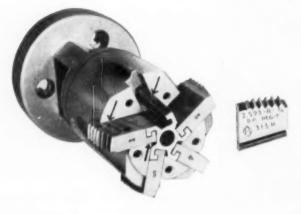
TWIST DIFILLS . REAMERS . COUNTERBORES - MILLING CUITERS . END MILLS . MODS - CARNIDE AND SPECIAL FOOLS



### LANDIS Taps for tapered threads

LL Collapsible Taps are available for producing internal tapered threads from 1-5/16" to 13-3/8" in diameter. The thread taper is produced by a mechanical receding action of the chasers during threading which reduces cutting strains by restricting cutting action to the chaser throat or chamfer section. As little or no "cold-working" can result, LL Taps are ideally suited for tapping tapered threads in stainless steel. These taps will also produce straight threads, and are available for either stationary or rotary applications.

Detachable heads are an important feature of all LANDIS Taps, and allow the tapping of a wide range of thread diameters with minimum tooling. For example, the 4 LL Tap body using 7 different Tap heads will tap all diameters from 2-7/8" to 7".



### Maximum Rigidity

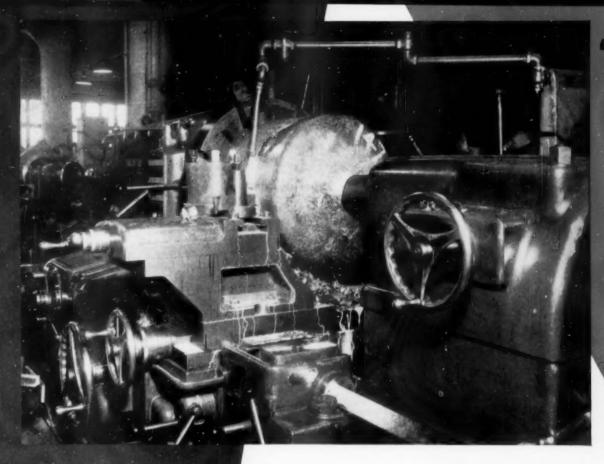
The basic design of all LANDIS Tap Heads assures maximum bearing support between the chaser, plunger and tap head body. In the cross-section illustration, note the heavy metal sections which provide rigidity to the chasers and plunger, particularly at the points where cutting strains are transmitted.

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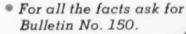


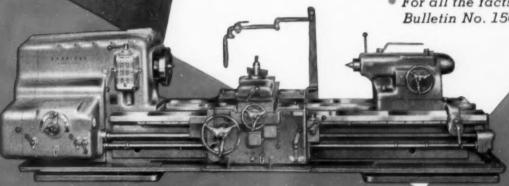
"Scalping" a \$12,000 TITANIUM Ingot...

The operation shown by the accompanying illustration is "scalping" (cutting) the hide off of an ingot of pure titanium sponge. The ingot is 25" in diameter and the skin or hide that must be turned off is from 1/2" to 1" thick.

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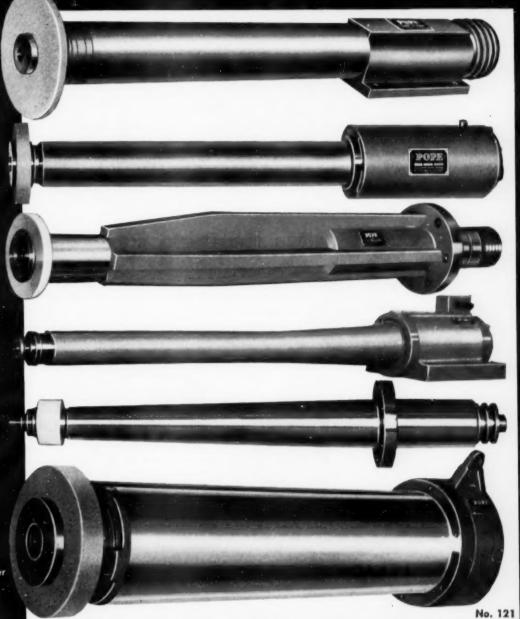
POPE P-18840-A 7½ — 7½ HP, 900-1800 RPM Motorized Deep Hole Spindle with 50" barrel length

POPE P-5593
Belt Driven Deep
Hole Spindle with
56" barrel length

POPE P-5886 5 HP, 3600 RPM Motorized Deep Hole Spindle with 56" barrel length

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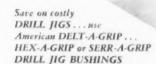
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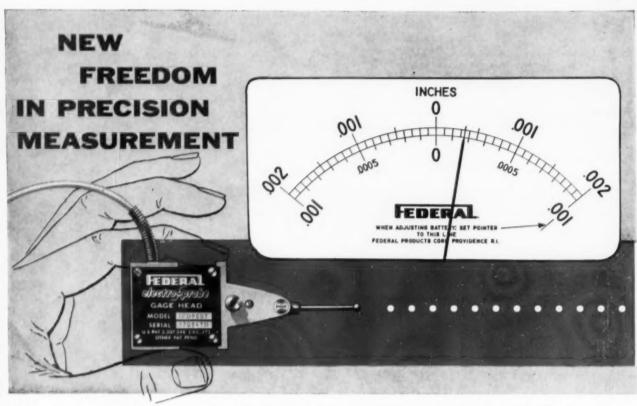
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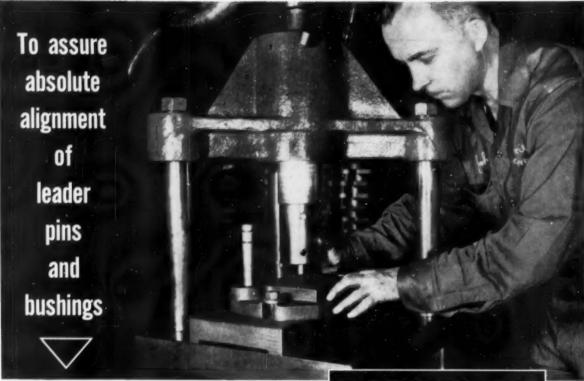
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Miller

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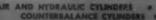
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Hydraulic Cylinde Tubing End Seal



BOOSTERS



# SHEF SEAL Obsoletes All Other Hydraulic Cylinder End Seals . . . at no added cost

### HAS EVERY ADVANTAGE

- Pressure Energized—Sealing Effectiveness Increased with Pressure.
- Zero Metal-To-Metal Clearance at all Pressures Gives You Perfect Seal Backup. Sealing Ring Cannot Extrude.
- Simplified Servicing. No "Blind" Assembly. Sealing Ring Cannot Shear.
- Teflon<sup>o</sup> Sealing Ring Withstands All Hydraulic Fluids at Temperatures from —100°
   F. to 500°
- Head and Cap Axial Movement Does Not Destroy Sealing.
- Allows Air Bleed In Head and Cap for Remote or Automatic Bleeding.
- One Sealing Ring Cross Section Dimension For All Cylinder Sizes—Supplied On Convenient Spools.
- Zero Metal Backup Clearance Eliminates Dangerous Leaks and Spurts of Fluid Due To Seal Failure.

### NONE OF THESE DISADVANTAGES

#### **GASKET CONSTRUCTION**

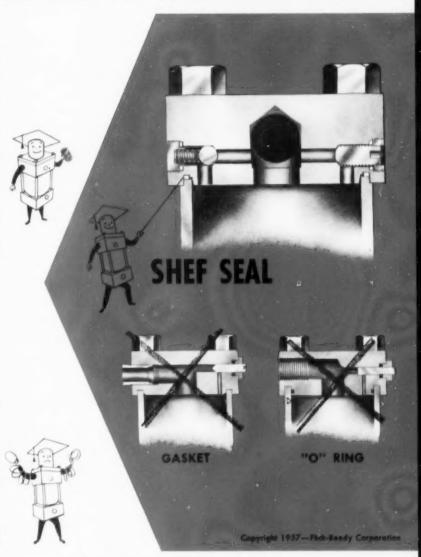
- Unpredictable Results—Leaks and Blows Even at Low Pressures.
- 2. Outlawed by J.I.C. Eight Years Ago.
- Seal Failure Causes Dangerous Leaks and Spurts of Fluid. Creates Unnecessary Fire and Safety Hazard.

### "O" RING CONSTRUCTION

- High Pressures and Shock Loads Expand Tubing—Increase Clearance and Cause Extrusion.
- Blind Assembly Can Shear Sealing Ring— Difficult Servicing.
- Seal Failure Causes Dangerous Leaks and Spurts of Fluid. Creates Unnecessary Fire and Safety Hazard.
- Requires Large Inventory of "O" Rings
   —For Servicing Variety of Cylinder Bores.
  - For Special Synthetic Rubber Compounds To Meet Ever Changing Fluid and Temperature Needs.

•du Pont trademark for its tetrafluoroethylene resin.

SHEF SEAL-Another Miller "First"



When you buy Miller ... You buy extra years of worry-free Cylinder performance

...at competitive prices



### OTHER MILLER QUALITY FEATURES

- All Teflon Sealed Against External Leakage—Teflon Cups Extra
- Case-Hardened Chrome Plated Piston Rod
- Shear Proof Rod Bushing Seal
- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
   Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers



Turn Page For More About MILLER

AIR AND HYDRAULIC CYLINDERS . ACCUMULATOR
COUNTERBALANCE CYLINDERS . BOOSTIES



All Teflon Sealed -Perfect Sealing for Hydraulic Cylinders

HAS EVERY ADVANTAGE.

Teflon—As Static and Dynamic Seals

- 1. Impervious to Every Hydraulic Fluid Including Fire-Resistant Types.
- 2. Seals Perfectly in Cylinders at Temperatures from -100° F. to 500° F.
- 3. Can Be Molded Into Shapes That Have Zero Leakage—Hold Pressure Indefinitely.
- 4. With Proper Design of External Seal Cavities, Teflon Can Be Included Without Increasing Prices. Miller Provides Teflon for all External Seals at Prices Competitive with Ordinary Cylinders. Leather Internal Piston Cups are Standard (Teflon Cups Extra).

edu Pont trademark foe its tetrafluoroethviene resin



2010 N. Hawthorne Ave., Melrose Park, III.

When you buy Miller You buy extra years of worry-free Cylinder performance ... at competitive prices

### NONE OF THESE DISADVANTAGES

### Synthetic Rubber-As Static and Dynamic Seals

- 1. Unsatisfactory Except When Used With A Limited Range of Hydraulic
- 2. Even Uncontrollable Changes in Fluid Additives Often Destroy Seal.
- 3. Specific Compounds Needed for Compatibility with Specific Fluids Normally Used Today.
- 4. Normal Temperature Range Limited to 0° F. to 130° F. Slightly Reduced Life When Operated at 130° F. to 150° F. Greatly Reduced Life at 150° F. to 250° F.
- 5. External Leakage Causes Fire and Safety Hazards When Temperature or Fluid Destroys Seals.
- 6. "U" Type Seals Without Mechanical Retainer at Mid-Section Frequently "Roll" and Lose All Sealing Ability.

### Resin Impregnated Leather— **As Dynamic Seals Only**

- 1. Is Compatible with Many-But Not All-Hydraulic Fluids and Additives Including a few Fire-Resistant Types.
- 2. Normal Temperature Range Limited to -60° F. to 130° F. Slightly Reduced Life When Operated at 130° F. to 150° F. Substantially Reduced Life at 150° F. to 250° F.
- 3. External Leakage Causes Fire and Safety Hazards When Temperature or Fluid Destroys Seals.

Miller Uses Leather Piston Cup Seals for Internal Sealing . . . Standard Price (Teflon Cups Extra).

### Piston Rings-**As Dynamic Internal Seals**

- 1. Most Piston Rings Allow Some Leakage.
- 2. Allow "Slip" or "Drift" of Piston Due To Leakage-Unsatisfactory for Many Applications.
- 3. Allow Varying Feed Rates Due To Leakage Because Of Viscosity Change During Startup-Unsatisfactory for Most Multiple and Automated Operations.
- 4. Allow Some Pressure Loss.
- 5. Chips and Dirt Enter Space Between Piston and Tube Causing Scoring -Especially During Startup.

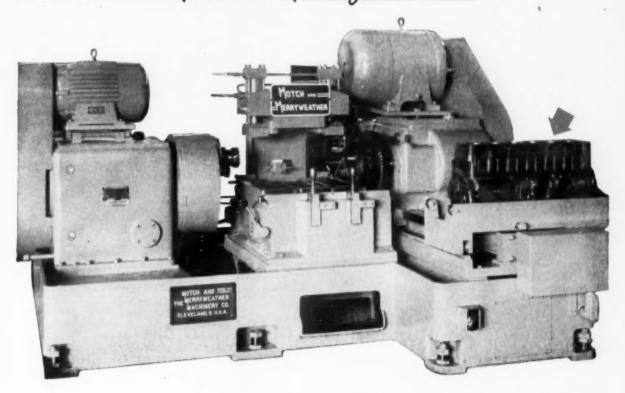
All Teflon Sealed—Another Miller "First"

### OTHER MILLER QUALITY FEATURES

- All Teflon Sealed Against External Leakage—Teflon Cups Extra
- Case-Hardened Chrome Plated Piston Rod Shear Proof Rod Bushing Seal
- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
- Rust Resistant Surfaces
- Tefion Oil and Dirt Wipers



### M4M develops another specialized machine



# Special Duplex Milling Machine

more than doubles milling production on cylinder blocks A prominent automotive manufacturer—comparing this M&M machine with previous equipment used to mill ends of cylinder blocks—reports:

In addition to boosting production from 22 to 50 blocks per hour, this M&M machine has greater strength in planetary milling unit, gives longer cutter life and more accuracy. Its extreme rigidity permits rough and finish operations in one pass of the heads.

An operator positions the block in the fixture where it is automatically clamped. The right hand head feeds across one end of the block while the left hand planetary head profiles the flywheel housing mounting surface. Cutters rapid traverse back, fixture is unclamped and finished block is removed.

Machine Tool Manufacturing Division



Cleveland, Ohio

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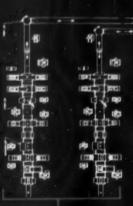
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#### SECTION VI

Blocks enter with ends exposed. After tapping ends and top, they are rotated to car position for tapping banks and sides. Final position is bottom up for tapping pan rail and under banks.

### SECTION V

Valve lifter holes are drilled, rough reamed, finish reamed and inspected.

#### SECTION IV

With blocks in car position, mounting pads are milled, cylinder head bank foces are drilled, chamfered and counterbored and deep oil holes are drilled.

#### SECTION III-

Blocks are turned on sides. Then distributor hale is rough and semi-finish bored, all holes in top are drilled and chamfered and crankshaft bearing cap holes and oil holes are drilled in bottom.

### SECTION II-

Blocks are turned 90 degrees, all holes in ends are drilled and chamfered, three oil gallery holes are pressure tested and cam shaft bearing diameters are rough bored. Then blocks are turned to car position.

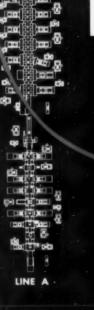
#### SECTION I

Blocks enter bottom up. Oil pan screw holes are drilled, transfer spots are machined in pan rail, under banks are drilled and chamfered and blocks are turned to car position.

### 1300 ft. Transfer-matic **Performs** 2291 Operations on V-8 Blocks

Here is the answer to the automobile industry's insistent request for machine tools which will reduce the cost of model changes and shorten change-over periods. This giant "Sectionized" Transfer-matic is constructed with an entirely new set of Cross building blocks and applies new concepts of standardization to machine bases, transfers, fixtures and heads.

- \* Capacity to machine any passenger car engine block.
- \* 270 stations in 17 sections, each with independent controls; sections operate automatically as blocks are made available; any section may be stopped without interrupting production of others.
- \* 2291 operations on 185 blocks simultaneously.
- \* Rated capacity of 350 cylinder blocks per hour.
- \* Cross Machine Control Units with Toolometers for efficient tool programming.
- \* Pre-set tools to reduce downtime.



Another Automation First by Cross

Photo shows Sections II, III, IV and V of Line A.

Established 1898

THE CROSS

First in Automation

PARK GROVE STATION . DETROIT 5, MICHIGAN

"Competitors wonder how I'm cutting production costs... the answer is

Electrolised

Production costs are tough to co

Production costs are tough to control nowadays. But if you can get up to 100% more production out of the cutting tools you use . . . then you've got a real competitive edge.

That's exactly what you can do, with Morse Electrolized Tools on your machines. Not only do you get more production, but you get it cleaner and faster with more closely held tolerances over a longer period of time.

Another reason why . . . MORSE means "THE MOST" in cutting tools.

MORSE TWIST DRILL & MACHINE COMPANY, NEW BEDFORD, MASSACHUSETTS

A Division of VAN NORMAN INDUSTRIES, INC. Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

# MORSE Cutting Tools



October 1957

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-25

### OSBORN BRUSHING METHODS worthy of your confidence



BEFORE BRUSHING

AFTER BRUSHING



### Centerless Brushing Method

### quickly produces precision finish



Oshorn Matico Brush puts final finish on aluminum pistons.

WHEN it comes to precision finishing of cylindrical parts, Osborn's Centerless Brushing method does the job quickly and efficiently.

The aluminum pistons shown above are fed across the face of an Osborn Matic\* Bufcut\* Brush mounted on a standard centerless grinder. Feather burs are thoroughly removed, surface junctures blended, and surface finish refined . . . automatically and economically.

A wide range of cylindrical parts can be processed in a similar

An Osborn Brushing Analysis, made in your plant at no obligation, will demonstrate how Osborn Power Brushing Methods can help automate your operations... improve your product. The Osborn Manufacturing Company, Dept. K-39, Cleveland 14, Ohio.

Write Today for the new 100-page Osborn Catalog 210-C.



BRUSHING METHODS . POWER, PAINT AND MAINTENANCE BRUSHES . BRUSHING MACHINES . FOUNDRY MOLDING MACHINES

# The Key to Controlled Measure!

Bath Gages open the door to a higher standard of inspection; guarantee absolute controlled measure of threaded and plain parts and holes . . . improve the quality of machined parts and the finished product.

BATH

Write for Bath Gage line folder on your business letterhead.



JOHN ATH & CO., Inc.

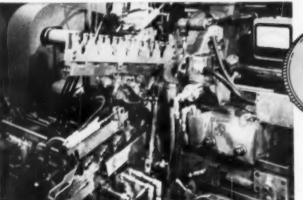
28 Mann St., Worcester, Mass.

CYLINORICAL AND THREAD GASES - GROUND THREAD TAPS - INTERNAL MICROMETERS

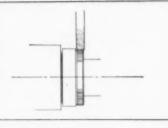
# The more you grind the more you save with Norton.

cost-cutting automatic operations

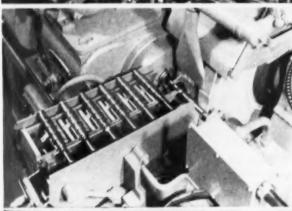
Typical automatic features on Norton grinders



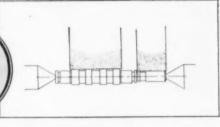
SAVINGS ON Transmission



In a Type CTU Cylindrical Grinder arranged for completely automatic loading, grinding, and unloading of transmission gears, the part is held on a chuck and grinding cycle is terminated by an automatic air-electric grinding gage that signals when work is to size.



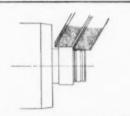
Valve Pistons



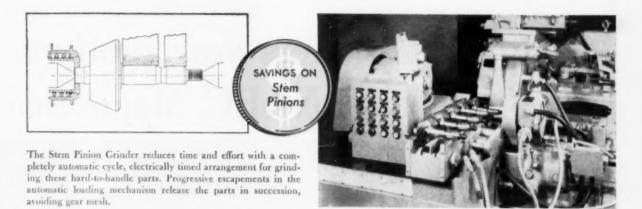
When a Type CTU Grinder is arranged for fully automatic loading and grinding of valve pistons the part is held on centers and driven by a floating type collet. Work is ground by a double-wheel mount.



SAVINGS ON Transmission Sleeves



On this Type CV-4 Angular Wheelslide Grinder chucked grinding of transmission sleeves is arranged in a completely automatic cycle. Longitudinal movement of a revolving turret loads the machine. A stripper type plate removes the piece when turret retracts as the grind is terminated by electrically timed control.



### NEW ECONOMY!

### Norton No. 2 Unitized Transfer Grinder Grinds Crankpins Automatically

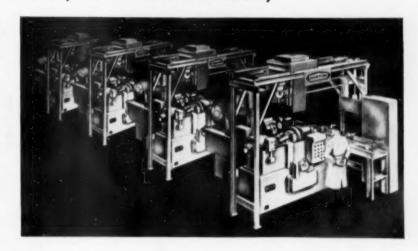
Here's a newly developed machine that automatically grinds crankpins faster and for less money than ever before possible. Advanced features like the following are reasons why:

Unitized Operation. Each grinding station, operating independently, can be automatically by-passed without affecting continuous production.

New Transfer Mechanism. Double set of hooks speeds loading, unloading and transferring of crankshafts from one grinding unit to another.

Fost Production. Cycling grinds 240 crankpins on 60 V-8 crankshafts per hour, due to many automatic operations.

Only One Operator Needed. Others are freed for different jobs. And the machine reduces floor-space requirements,



Norton has developed a wide range of fast, automatic grinders. You can get them in conventional and angular wheelslide types — also in special types for grinding automotive valve faces and crankshaft pins.

Remember: only Norton offers you such long experience in both grinding machines and wheels to bring you the "Touch of Gold" that helps you produce more at lower cost.

For further information about these machines — including how the No. 2 Unitized Transfer Crankpin Grinder can save you many dollars daily — contact your Norton Representative. Or write to Norton Company, Machine Division, Worcester 6, Mass.

District Offices:

Worcester . Hartford . Cleveland . Chicago . Detroit

To Economize, Modernize with NEW



GRINDERS and LAPPERS

Making better products ... to make your products better

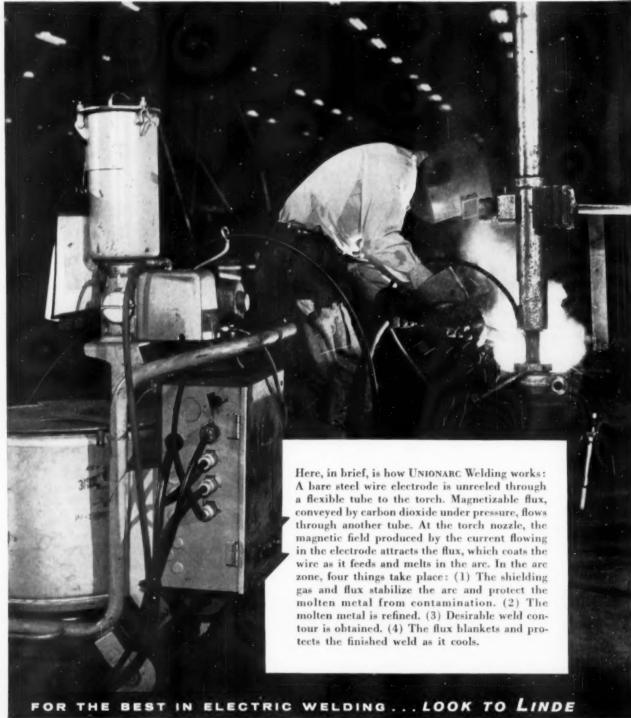
#### NORTON PRODUCTS:

Abrasives . Grinding Wheels . Grinding Machines . Refractories

### BEHR-MANNING DIVISION

Coated Abrasives . Sharpening Stones . Behr-cat Tapes

# Wow...LINDE offers you another UNIONARC Magnetic



### modern welding method— Flux Gas Shielded Arc Welding

UNIONARC is an entirely new method of welding steel in all manual positions...

### VERTICAL



### **OVERHEAD**



A completely new concept for manual welding of mild steel has been developed by LINDE. Called UNIONARC Welding, the method uses a continuously-fed bare steel wire electrode, which is magnetically coated with flux and shielded by carbon dioxide. The torch can be easily handled in all welding positions—vertical, overhead, downhand. Manual welds can be made at higher speeds and at lower cost than with covered electrodes. UNIONARC Welding produces high-quality welds in steel, even when moderate amounts of rust, scale, and moisture are present.

Among the numerous advantages of UNIONARC Welding are these: Rate of operation is up to three times faster than with covered electrodes. There is no stopping to renew electrodes, since a single loading of wire can be fed smoothly and continuously for periods up to a week. Manual skill needed is no more than that required with covered electrodes. In vertical and overhead positions, the deposition rate in UNIONARC Welding is two to three times greater than with covered electrode methods; in downhand positions, up to twice as great. There is practically no spatter—

the little that appears is easily brushed away, leaving a clean, smooth weld.

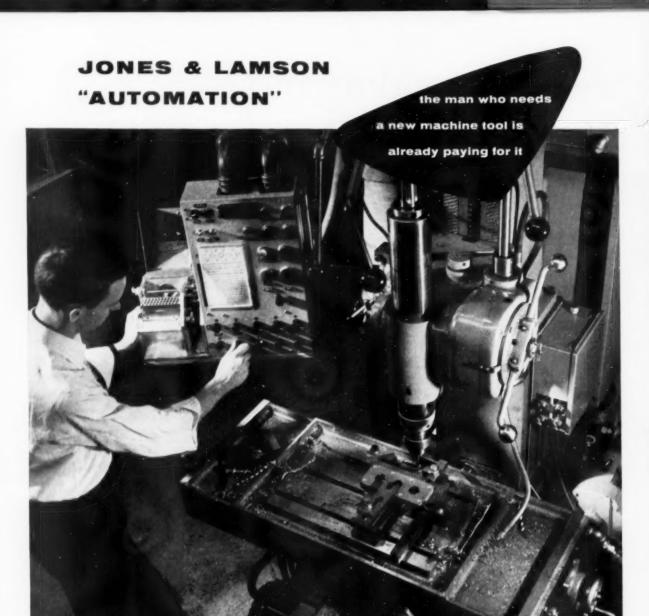
LINDE has made many notable contributions to welding. Among these are the introduction and development of submerged are welding (UNIONMELT Welding), non-consumable electrode, inert gas shielded are welding (HELIARC Welding), and the development of Sigma (shielded inert gas metal are) welding. LINDE's newest method, UNIONARC Welding, is another first—a truly important contribution. Its simplicity and versatility make it unique. Its efficiency and economy have been proved in actual production work. Write now for details about UNIONARC Welding, or call the LINDE office nearest you.

LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. Offices in other principal cities. In Canada: Linde Company, Division of Union Carbide Canada Limited.

The terms "LINDR," "HELIARC,"
"UNIONMELT," "UNIONARC,"
and "UNION CARRIDE" are
trade marks of Union Carbide Corporation



inde UNION CARBIDE



### This tape-controlled table eliminates set-up time on small lots

It's natural enough, in a way, to associate "automation" with huge plants and their long, high-speed production lines.

We should also keep in mind, however, that certain "automation" techniques offer tremendous benefits to the *small job shop*. Jones & Lamson research and development have produced remarkable results in applying "automation" to small-lot production.

Are you interested in drastically cutting setup and change-over time, and greatly increasing your small-lot flexibility? We'd be pleased to show you how the results of our intensive research and development programs can be put to good use in *your* operations.

Write for literature. Jones & Lamson Machine Company, 518 Clinton Street, Springfield, Vermont.

# with A.I.S.I. Identification and Type Classification of Tool Steels Columbia Tool Steels for 1957-58

Columbia SPECIAL W1 Columbia EXTRA W1 EXTRA HEADERDIE W1 Columbia STANDARD W1	.60/1.40 .60/1.40 .60/1.40 .60/1.40	WATER	HARDEN	ێ	Z	>	*	Me	3	8
L SIE ARD	.60/1.40 .60/1.40 .60/1.40 .60/1.40	WATER	HARDEN							
L OIE ARD	.60/1.40	1		ING TOO	WATER HARDENING TOOL STEELS		- TYPE SYMBOL W	BOL W		
OIE ARD	.60/1.40		1	1	1	1	1	1	1	1
DIE ARD	.60/1.40	1	1	1	1	1	1	1	1	1
	.60/1.40	ı	1	1	1	1	1	1	1	1
W Carry Commission	40/4 40	1	1	1	ı	1	1	1	1	1
Alimahia El ECTOEX	04.1/00.	1	1	1	1	1	1	1	1	1
VANABILIM EXTRA W2	.60/1.40	1	1	1	1	.25	1	1	1	1
VANABILIM STANDABD W2	.60/1.40	1	1	1	1	.25	1	1	1	1
Washington Wa	1.00	1	1	1	1	.50	1	1	1	1
***	.60/1.40	1	1	.25	1	1	1	1	1	1
WATERDIE EXTEN	1.10	1	1	.50	1	1	1	1	1	1
WATEBUIE CTANDARD WS	1.10	1	1	.50	1	1	1	1	1	1
We West	1.00	1	1	.25	1	.25	1	1	1	1
W7	1.00	1	-	.50	1	.20	1	1	ı	1
		SHOCK	K RESIST	RESISTING TOOL	L STEEL	STEELS - TYPE	E SYMBOL S	S 70		
S	.50	1	1	1.50	1	1	2.50	1	1	1
BOSTER St	.50	1	1.00	1	1	1	1	.50	1	1
83	.50	1	1	.75	1	1	1.00	ı	1	1
3	.55	.80	2.00	ı	1	1	1	1	1	1
SS STATISTICS SS	.55	08.	2.00	1	1	1	1	.40	1	1

First of a Series of Six Charts Covering A.I.S.I. Tool Steel Type Classifications

# HEIGHTS, ILLINOIS CENTRAL OFFICE AND WORKS, CHICAGO HEIGHTS, ILLINOIS — BRANCH STOCKS IN THE FOLLOWING CITIES: CHICAGO • COMPANY STEEL TOOL COLUMBIA

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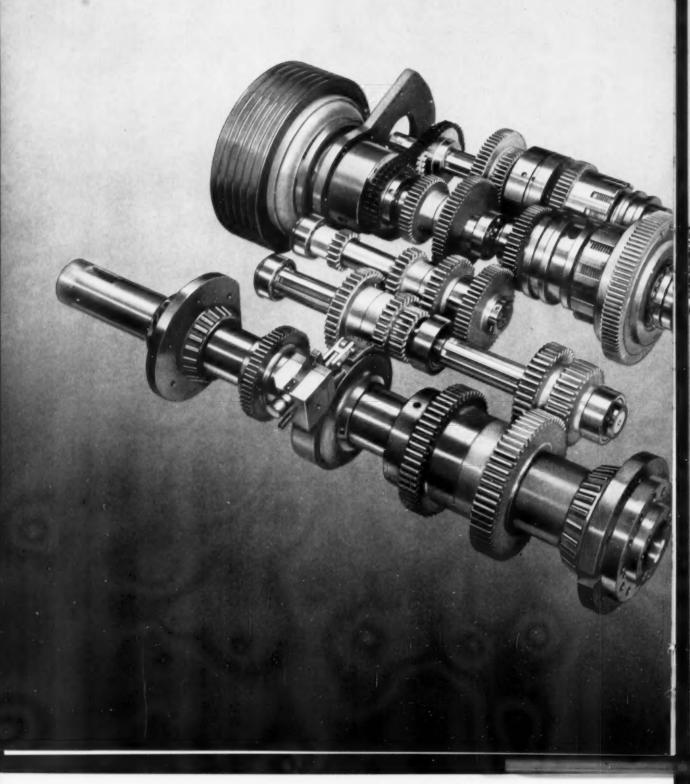
REPRESENTATIVES IN THE FOLLOWING CITIES: Dayton, Erie, Grand Rapids, Harford, Indianapolis, Louisville, Moline, Newark, Portland and St. Paul





HOT WORK STEELS. Clarite HW - Formite No. 3 - Formite No. 2 - Molite HW10 - Vanadium Firedie - Alcodie - Firedie HIGH SPEED STEELS, Clarite - Vanite - Carvite - Acmire - Cobis - Maxite - Molite - Molite Smoothcut - Molite s 3 DIE STEELS. Superdie - Atmodie - E-Z-Die Smoothcut — Oildie — Exl-Die — Framdie The power reserve and range of speeds

### YOU'LL NEED FOR THE



### TOOLS OF TOMORROW

### New GISHOLT MASTERLINE SADDLE TYPE TURRET LATHE

WANT MAXIMUM OUTPUT AND ACCURACY from today's carbide tools—with an ample reserve of power and speeds to meet tomorrow's tooling requirements?

That's what you'll get—now—from this powerful, rugged Gisholt MASTERLINE Saddle Type Turret Lathe. Prime example of this machine's advanced features is the rugged Headstock Gear Train, shown at the left. Here, you can get 24 different forward speeds—all from a single-speed motor. This means you get full power all the time—a critically important feature for those heavy cuts at punishing feeds.

But that's not all. To give you maximum performance from this powerful gear train, Gisholt designers have backed it with faster speed changes through the Hydraulic Speed Selector (effortless speed shifts without waiting or computing); a hydraulically operated Hi-Lo speed change in a 6:1 ratio (without stopping the spindle or shifting gears); and a new Self-Adjusting Electric Clutch and Brake (smooth, fast starting and stopping, plus more accurate inching of the spindle).

Ask your Gisholt Representative to give you the complete facts. Why not call him today?



G SMACHINE COMPANY



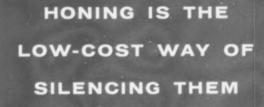
Madison 10, Wisconsin, U.S.A.



# GEAR TOOTH NICKS and "HICKIES"





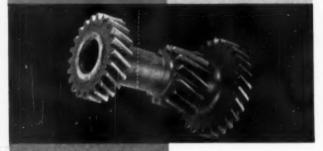


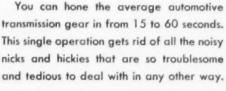










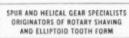


But that's not all. Red Ring honing also improves over-all surface finish—down to 2-4 microinches if necessary.

The initial pass under the honing tool is an effective inspection procedure in that it immediately reveals any distortions that may exist in tooth profile, spacing and pitch diameter runout. When such distortions are not excessive, honing corrects them.

If you want to reduce the cost of silencing noisy gears (1" to 12" PD), write for Bulletin H 57-2.



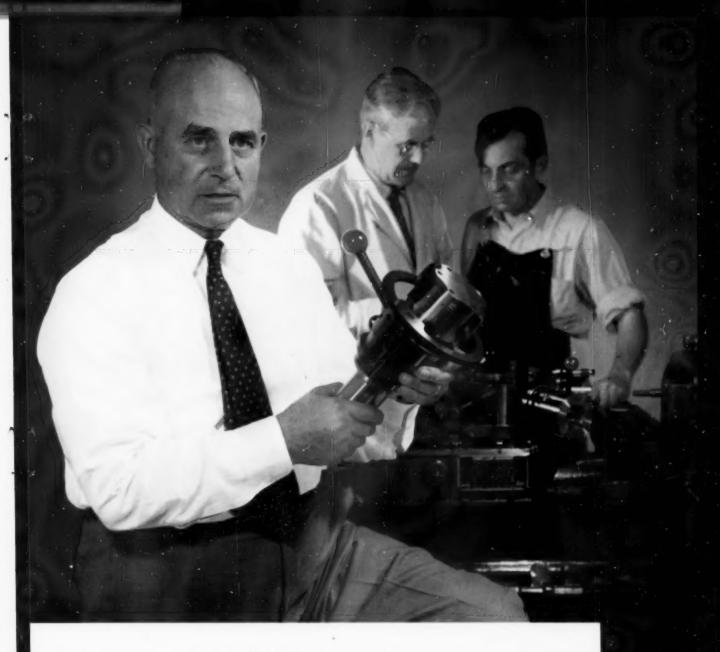


7810

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT



John Topman, Factory Superintendent, says:

### "I LIKE GEOMETRICS because . . .

... I'm interested in production schedules, costs and quality control. GEOMETRIC tools suit me on all counts, they're dependable, economical and, of course, you can't beat them for accuracy. Just look at the workmanship in this collapsing tap!

Their distributors and their own service engineers give us wonderful cooperation, too. Yes, I'm sold on GEOMETRIC Die Heads and Collapsing Taps."

Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

New Haven 15, Connecticut



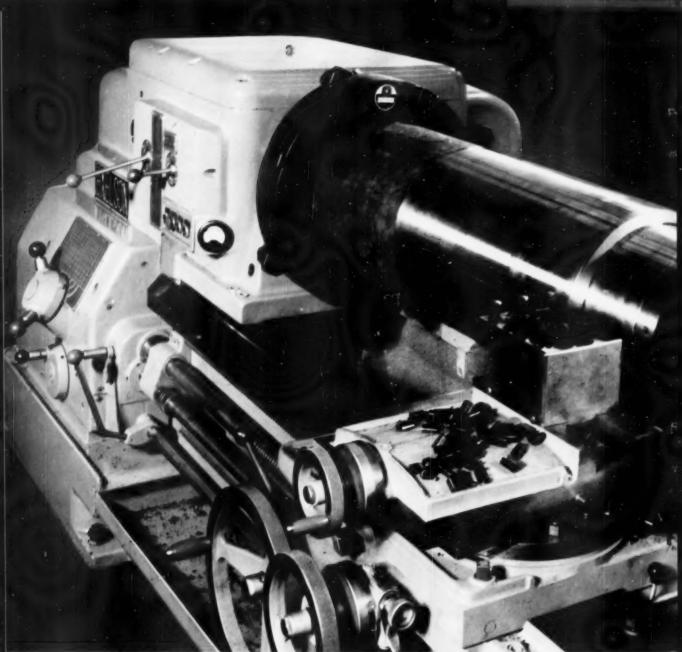


Photo courtesy of the Axelson Manufacturing Company

THE LATHE - Axelson New 4025 Heavy-Duty Engine Lathe

THE OPERATION - Turning a 16-inch billet

THE CHUCK - Horton, of course

### HORTON CHUCK DIVISION

Greenfield Tap and Die Corporation

Windsor Locks, Connecticut



Call Your Horton Distributor Now!



# Tool Steel Topics





### **Brake Die saves shop time** in forming overlap for steel spout

The problem sounded simple enough putting an overlap in a section of 20gage stainless steel, which was then formed into a spout for use in meatpackaging tables. But getting a tool steel which could do the job more economically than the grade formerly used was somewhat of a challenge for the manufacturer, J. B. Dove & Sons, Inc., Philadelphia.

The answer was Bethlehem Brake Die, supplied by our local tool steel distributor, Hill-Chase & Co. Because of Brake Die's easy machinability and good wearresistance, the new die minimized manufacturing costs. It also helped in producing a, better-looking product. Said one of the Dove engineers: "We like Brake Die, It's doing a good job for us."

Brake Die, a special alloy steel, is oilquenched and tempered to develop a fine balance of mechanical properties. It's ideal where wear-resistance, toughness, resistance to impact and good machinability are required.

Typical Analysis

Carbon 0.50 Manganese 0.90 Chromium 1.00 Molybdenum 0.20

Chances are there might be one or more applications in your shop right now where Brake Die steel could be used to good advantage. Why not talk it over with your Bethlehem tool steel distributor?

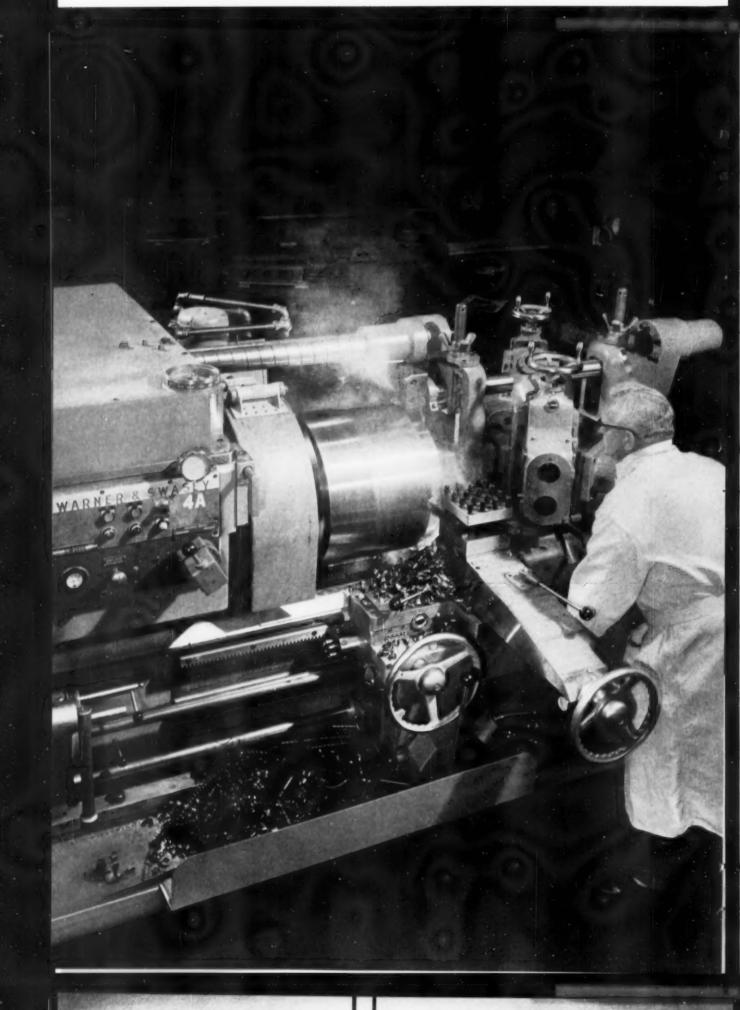
### BETHLEHEM TOOL STEEL ENGINEER SAYS:

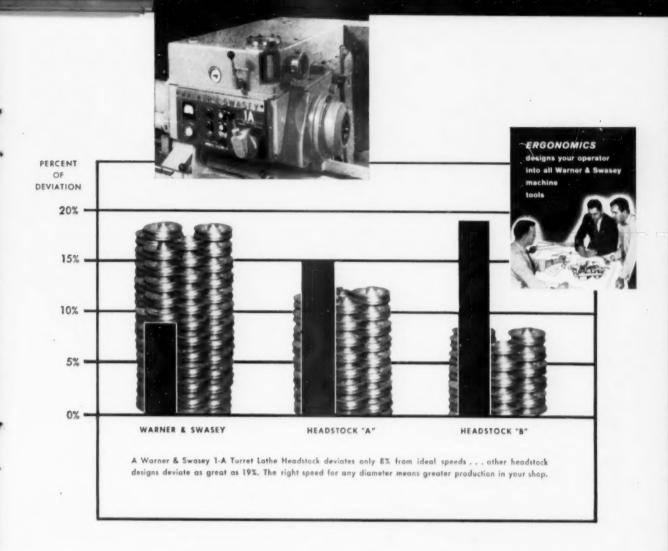


How to Shrink-Fit Tool Inserts

Shrink-fitting of tool steel inserts is a procedure which is being widely used to improve the service life of tools, Shrinkfitting is most applicable to rings and cylinders, such as are used in heading and drawing operations where the tools can be shrink-titted into large retaining rings. The shrink-fit sets up radial compressive stress in the tool, which is available to oppose radial tensile stress set up in service, and thereby improves the performance as compared to solid tools which are not pre-stressed. Shrinkfitting of tools should be carried out as

- 1. The retainer must be of adequate diameter and strength to provide the stresses required on the tool insert. This generally means that an alloy steel capable of hardening to approximately 300/400 BHN must be used. Shockresisting tool steels heat treated to approximately Rockwell C 48 to 52 are used on heavy duty applications. It is recommended that the OD of the retainer. be a minimum of twice the ID (preferably three times the ID).
- 2. A shrink-fit allowance of .003/.004 in. per in, should be provided for. This means that the OD of the insert is .003/.004 in. per in, larger than the ID of the retainer into which it must fit. These dimensions must be carefully maintained in order to obtain the benefits of shrink-fitting.
- 3. The OD of the insert and the ID of the retainer should have a smooth finish, preferably produced by grinding.
- 4. The retainer should be heated to a temperature sufficient to cause the expansion necessary to assemble the insert. Care should be exercised not to exceed the tempering temperature used in heattreating the retainer. If necessary, the insert may be sub-zero cooled to aid in providing the clearance required for assembly.
- 5. After assembly of the parts, cooling of the assembly should be rapid enough to prevent over-tempering of the insert by heat transferred from the retainer.





### Warner & Swasey hydraulic **HEADSTOCKS**provide operators better choice of proper cutting speeds

Warner & Swasey's new, more powerful hydraulically-controlled headstocks are being hailed by turret lathe operators everywhere. They like the greater range of preselected cutting speeds — instantly available by a touch of the hand. (With a two-speed motor, they can now get twice as many unduplicated speeds.)

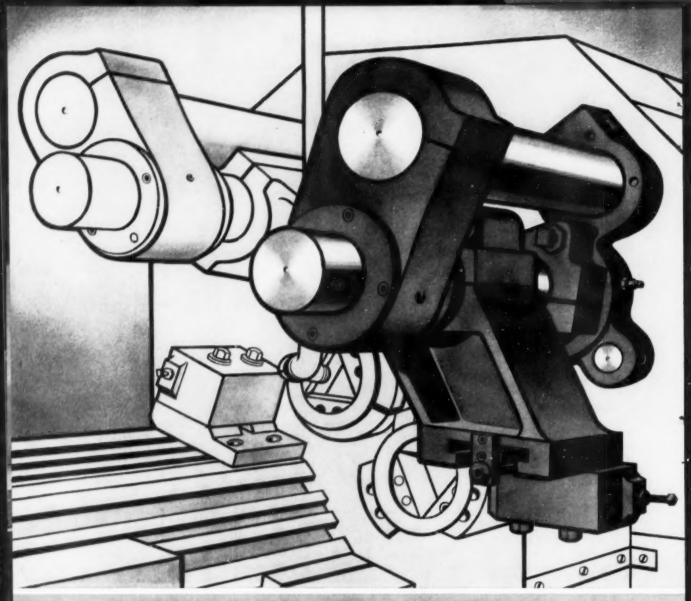
Control is so easy and effective — one master lever shifts gears and handles spindle stops, starts and reverses.

Operators can easily choose in advance the most effective speed for each cut from Warner & Swasey's exclusive direct-reading Preselector. When required, it's effortlessly picked up merely by pressing the control lever. No wonder they prefer to operate Warner & Swaseys.

On Warner & Swasey's No. 4 and No. 5 Ram Type and 1-A Saddle Type Turret Lathes, direct-acting, self-adjusting hydraulic clutches with a constant mesh gear train instantaneously make the preselected speed change at the touch of a lever.

Our larger Saddle Type (2-A, 3-A and 4-A) headstocks employ hydraulic pistons to shift gears after the gear train has been automatically slowed to shifting speed.





### 3 money-making advantages

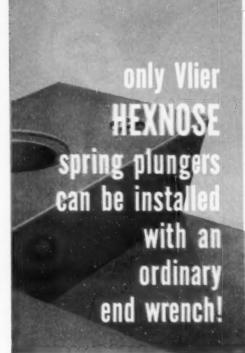
### from 1 exclusive New Britain feature

New Britain's exclusive swinging arms can do everything a cross slide can do, and:

- You can position them for any length piece.
- You can turn O.D.'s and I.D.'s and faces with single point tools.
- You can combine transverse and longitudinal motions to turn tapers or radii and do recess boring.

Before you invest in automatics, check New Britains. Their "do more" principles can produce a greater return — often it's the difference between a single machining and the need for secondary operations. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

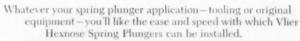




Hexagonal nose eliminates need for spanner-type wrenches; speeds insertion, adjustment and removal!

PATENT NO. 2,781,814

THERE'S A VLIER SPRING PLUNGER FOR ALMOST EVERY CONTROLLED-END-PRESSURE APPLICATION!



No more hunting for clumsy-to-use spanner-type wrenches or special screw drivers—any ordinary end, socket or crescent-type wrench will do the job quickly and easily.

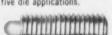
Since the plunger nose is always easily accessible, the Hexnose really pays off where periodic adjustments must be made. Hardening both body and plunger assures body life. Available in both standard and light end pressure models; 11 sizes.

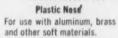
### Same sturdy construction as other Vlier spring plungers

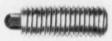
- Large bearing surface overcomes binding, assures perfect alignment of the plunger at any extension.
- Concentricity between plunger axis and body diameter held to .0015" T.I.P.R.
- Rust-proof finish and National Coarse Class 2A threads prevent freezing in threaded hole.
- Plunger end telescopes completely within body. Case-hardening assures extreme wear resistance. Ductile core overcomes brittleness and hazards of fracturing under impact, common with hardened, high carbon steels.
- Spring pressures are accurate, uniform and dependable.
- 6 Accurately radiused nose speeds loading and unloading of jigs and fixtures.



### Silvernose Light end pressure for repetitive die applications.







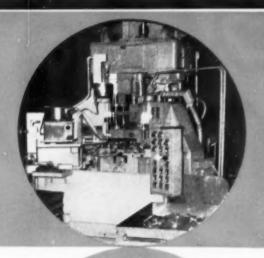
For greater ease in installing, adjusting and removing.





ENGINEERING

1900 Sonta Monica Blvd., Los Angeles 44. Californi





Two sizes of motor end-plates are assembled, bored, drilled and tapped in a Natco 3-Way Machine.

At Wagner Electric Corporation

One Natco





### Assembles, Bores, Drills and Taps... Reduces Labor Cost 70% On Small Motor End-Plates

This Natco combination assembly and multi-drilling machine presses a bearing sleeve into the end-plate, rough and finish bores the outside bearing-cap hole, drills an oiler hole at an angle, drills four (4) thru-bolt holes, and drills and taps two (2) 8x32 cover plate holes. Production is 170 pieces per hour.

This Natco accommodates two sizes of motor end-plates without changes in the basic rotary-table tooling. In addition to this important versatility the engineers at Wagner Electric point out these other advantages:

- one operator controls the assembly and machining from one station.
- work scheduling is simplified due to the short machine cycle.
- in-process inventory can be kept at a minimum because of high production rate.
- floor space is made available for other operations.

Natcos perform all kinds of drilling, boring, facing and tapping jobs in every conceivable combination and sequence.

Ask the Natco Field Engineer about the newly perfected tape control systems for Natco production tools.

### National Automatic Tool Company, Inc.

Richmond, Indiana Mutt-spindle drilling, boring and tapping mechines. Special mechines for automatic production.

Call Natco Offices in Chicago, Detroit, New York, Buffalo, Philadelphia, Cleveland, Los Angeles; distributors in other cities.



### TO REDUCE WELDING COSTS JETWELD IT!

Lincoln Jetweld iron-powder electrodes increase welding speeds as much as 50%. Higher welding currents, greater deposition rate, and self-cleaning characteristics make possible drastic reductions in welding labor costs.

Weld appearance is smoother, approaching the bead quality of an automatic weld.

The Lincoln Jetweld family of iron-powder electrodes is available in four different classifications to meet a wide variety of welding requirements.

**E-6024 Jetweld 1** for extra-fast welding of flat and horizontal fillet with AC or DC.

**E-6027 Jetweld 2** especially well-suited for deep groove butt welds in the flat position.

**E-6016 Jetweld LH-70** for all-position welding of all steels and for welding steels of poor weldability.

**E-7020 Jetweld 2-HT...** for high-tensile deep groove butt welds and fillets in flat position.

For complete information on Jetwelding or the Jetweld electrodes, write for Bulletin SB-1351.

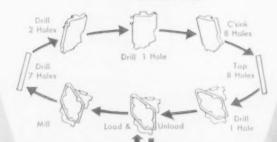
### THE LINCOLN ELECTRIC COMPANY

Dept. 5017. Cleveland 17, Ohio The World's Largest Manufacturer of Arc Welding Equipment

When Jetweld electrodes Have higher deposition rates

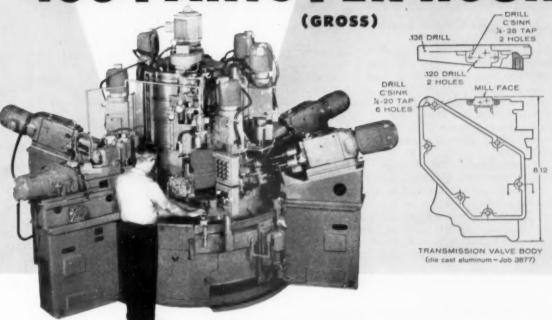
Yet give easiest operating qualities WHY
use anything
but Jetweld

- drilled
  - countersunk
    - tapped
      - milled





RTS PER H



... on this 8-station KINGSBURY INDEXING AUTOMATIC

Eight fixtures are mounted on a 60-inch index table. The part is tipped back in each fixture so that the high speed (7200 rpm) milling operation is horizontal. Five vertical units on the central column operate on the holes in this milled face. Three angular units operate on the six mounting holes.

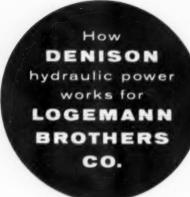
All units operate at once, while the operator is changing parts in his fixture. He presses buttons to actuate the clamping, unclamping and indexing mechanisms. A Kingsbury indexing automatic is the best way to perform drilling types of operations

- . . . at a high production rate
- ... at low unit cost
- ... with unvarying accuracy.

Kingsbury Machine Tool Corporation, Keene, N. H.

KINGSBURY

INDEXING AUTOMATICS for high production drilling and tapping



### Putting more squeeze in presses

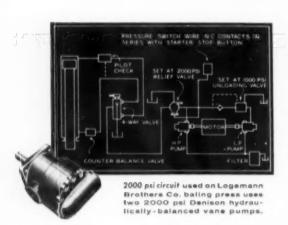
...another application for Denison hydraulic power

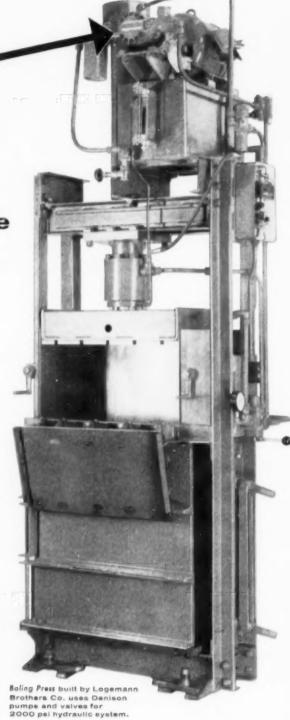
Here's how a leading manufacturer of baling presses assures peak performance for his product . . . combines it with dependability for long, continuous service.

Power and speed of operation are achieved by the use of two 2000 psi Denison TMC balanced-vane hydraulic pumps. One Denison pump is set for 1000 psi for fast ram approach. The second pump is set for 2000 psi to provide necessary pressure for the power stroke.

By using identical 2000 psi pumps, maintenance is simplified and pump life greatly increased.

Endless design problems can be solved by using Denison hydraulic equipment on systems up to 5000 psi. Your Denison representative (who is an experienced hydraulic specialist) will gladly show you how. Write us. Denison Engineering Division, American Brake Shoe Co., 1182 Dublin Road, Columbus 16, Ohio.





Denisin and Denison HydrOILies are registered trademarks of Denison Eng. Div. ABSCO

HYDRAULIC PRESSES . PUMPS . MOTORS . CONTROLS





# Teamed up to lick a tough job

ECONOMICALLY!

Latrobés

and pre-hardened

VISCUUNI 44

Die Casting Die Steels

Rack for assembling electronic parts
(approximately 2 feet long by 1 foot wide and weighing 2.05 pounds) produced for Northrop Aircraft, Inc., Northrop Div., Hawthorne, Calif.





Harvill Corp., Los Angeles, Calif. had to produce this part DEAD FLAT at a minimum cost...

The problem of producing this die casting die at a minimum cost was a natural for Latrobe's VDC and Viscount 44 die casting die steels.

The die parts, not affecting the critical flatness, were made of Latrobe's VDC die casting die steel, an air-hardening, 5% chromium die steel possessing excellent machinability and superior resistance to wash and heat checking. For the die parts demanding dead flatness, the use of Latrobe's Viscount 44 prehardened die casting die steel eliminated all possibilities of warpage from heat treatment and subsequent costly grinding time to correct warpage. Die surfaces were machined to exact size! Heat treat was eliminated!

Latrobe's Viscount 44 is an air hardening, 5% chromium die steel containing 1% vanadium that imparts excellent physical properties for hot work applications. Furnished prehardened, in a range of Rockwell C 42-46, Viscount 44 is practical to machine in its prehardened form as a result of the alloy sulphides it contains. Years of experience in the production of DESEGATIZED® steels have made it possible for Latrobe to uniformly distribute these free-machining sulphide additives throughout Viscount 44.

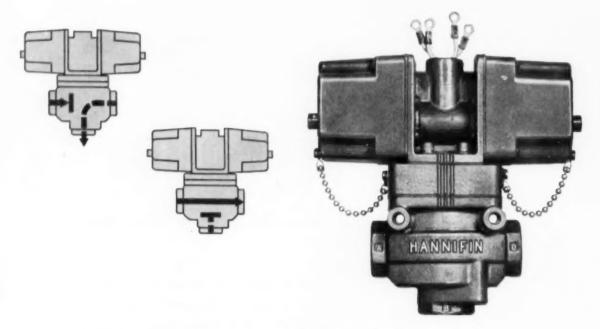
Use Viscount 44 for your next critical die casting application. Your nearest Latrobe representative will be pleased to give you complete data . . . and warehouse stocks are available for immediate delivery.

LATROBE STEEL COMPANY

Main Office and Plant: Latrobe, Pa. Branch Offices and Warehouses Located in Principal Cities

### Setting the pace for automation

### ... Hannifin valves



Automatic processes call for speed, sensitivity and flexibility in directional air control. Above all, they demand dependability. That is why so many valve users find it pays to choose Hannifin.

Every feature that contributes to dependable performance has been incorporated in Hannifin air control valves. This dependability is the result of never-ending research and development,

In the broad Hannifin line, you will find valves with new exclusive features...valves for practically any kind of automatic sequential operation. All are simple in design, with few and easily replaceable parts.

AIR CONTROL

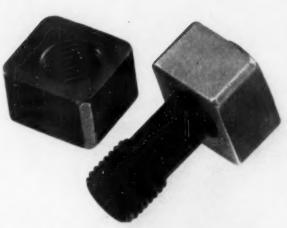
### HANNIFIN

VALVES

For this complete catalog showing all the Hannifin directional air control valves, write to Hannifin Corporation, 519 South Wolf Road, Des Plaines, Illinois.







# Jacobs

### CHUCKS

Superior performance is the result of the painstaking production of superior parts.

Jacobs and your industrial supply distributor deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

The Jacobs Manufacturing Company West Hartford, Connecticut



The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.



The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.



The Jacobs Model 96
Collet Chuck for grinding machines, millers and jig-borers.

The Jacobs Rubber-Flex® Tap Chuck designed for tapping and jig-borers.



The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.



The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use,

# Built to outlast others







Model 8100

# New ARO IMPACT WRENCH

- One-half inch, square drive, reversible, high-speed, 6,000 rpm.
- Impact mechanism consists of three functional parts.

WRITE for complete literature. See your Aro Distributor.

THE ARO EQUIPMENT CORPORATION

GENERAL OFFICES—BRYAN, OHIO Plants at Bryan and Cleveland, Ohio

Aro of California, 3141 S. Grand Ave., Los Angeles 7, Calif. Aro Equipment of Canada, Ltd., Toronto 15, Ontario • Offices in All Principal Cities



AIR TOOLS

Also ... AIR HOISTS .. LUBRICATING

### THE R and L TAP AND DIE HOLDER

TOOLS IN ONE!

It will be good news to many to learn that R and L has adapters for ACORN DIES and BUTTON DIES which are precision made to fit the R and L TAP AND DIE HOLDERS.

As you can see from the specifications and prices below, for a comparatively small investment an R and L TAP AND DIE HOLDER can truly become 6 tools in 1 . . . A Tap and Die



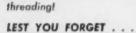




Figure 2. Instantly engaged to full contact between A and C as soon as top or die engages work.



Figure 3
fully released showing ample clearance
between contact
points of clutch preventing re-engagement or hammering
of clutch points in
case turret advances
slightly after clutch
releases.



... The R and L TAP AND DIE HOLDER has an entirely new releasing mechanism, and can readily be changed for right or left hand threading. No spring plungers to wear or break. No small screws to work loose.

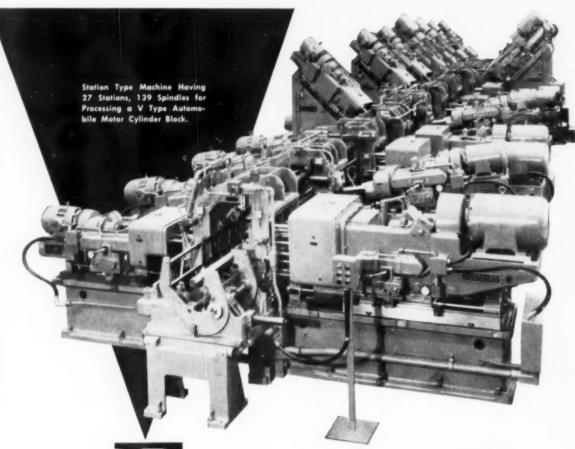
Holder . . . and Acorn Die Holder . . . and a Button Die Holder . . . For right and left hand

went and	un	O	O	LS
1825 BRIST	OL STREET	. PHILAS	ELPHIA	40. PA.

OTHER FAMOUS R and L TOOLS:

TURNING TOOL - CARBIDE OR ROLLER BACKRESTS - RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) UNIVERSAL TOOL POST - CUT-OFF BLADE HOLDER - RECESSING TOOL REVOLVING STOCK STOP - FLOATING DRILL HOLDER - KNURLING TOOL

	Please send me your new catalog  Please arrange for no-obligation
	☐ Please arrange for no-obligation demonstration of R and L TOOLS
NAME	
COMPANY	



# ROOTBURT station type machines

### PROGRESSIVE PRODUCTION ...

With the Station Type Machine, Footburt continues to provide the most modern developments in production machinery.

Drilling, reaming, tapping, milling, checking and testing may be combined in one station type machine, and units may be mounted at any angle.

Installations of Footburt Station Type Machines have been made in many leading automotive plants, in some case handling the major machining on the block and head components.

### THE FOOTE-BURT COMPANY, Cleveland 8, Ohio

Detroit Office: 24632 Northwestern Highway, Detroit 35, Mich.

ENGINEERED FOR PRODUCTION

carbíde

All you need to sharpen any of these WESSON tools is an Allen wrench . . .

(see page 2)

### in just ten seconds . . .

### carbide



A single turn loosens the insert clamp.



Just turn the insert to put "fresh" edge into cutting position.



Lock the clamp and you're ready to go.



A throw-away insert like this has eight cutting edges.

### How to Sharpen Tools with an Allen Wrench!

All of the **WESSON** tools shown on the preceding page are based on the use of indexable "throw-away" tips. When a cutting edge becomes dull, you simply index the tip to a sharp new edge. After all edges (up to eight) are dulled, the tip is simply discarded.

### Lathe Tools

Experience shows that **WESSON** throwaway tooling is economically suited to at least half of all single point tool operations. There is no tool grinding. Once set up on the machine there is no further setup time. Downtime for tool changes is reduced to the minimum. Ask for Bulletin #5510-M.

### Milling Cutters

Since it takes more time and costs more

to sharpen or set up milling cutters than single point tools, the economic advantages of throw-away tooling in milling cutters are multiplied over single point tools. Moreover, the new WESSON milling cutter body, developed and designed specifically for throw-aways, gives ample support even for those heavy roughing cuts. Each blade is indexed just as in a single point tool and requires no adjusting.

### **Boring Tools**

**WESSON** micro-adjustable boring tools with throw-away tips are sweeping the field. Setup is simplicity itself, an Allentype screw head being provided with a dial graduated to 0.001 inch (each turn is 0.025 in.). Once adjusted the tools stay put. Round, triangular or square inserts can be used with only minor parts changes. Ask for Bulletin #MB-157.

# PART STOCK REMOVED (MOSS TILD (MOSS TIL

### Working with Wesson Saves \$7200 On 1 Job

When you want to cut tool costs it often pays to break the cost down first. You can often cut it several ways. A WESSON service engineer helped prove this on machining OD's of tractor axle shafts.

Tool cost with brazed carbides on a 75 hp lathe was over \$2 per shaft.

A study showed that even though a good steel-cutting carbide was used, there was quite a lot of tool breakage. Frequent tool changes made grinding costs high. A lot of time was lost in setups. Pieces per grind also looked low.

The job was tackled progressively like this:

 The carbide was changed to Wessonmetal #26—a more versatile wide-range general purpose steel-cutting grade.

Its toughness cut the tool breakage way down and boosted pieces per tool change,

2 The tool type was switched to standard easy-to-grind-and-index 34" square "on end" inserts in WESSON SDR-86B holders.

This doubled the cutting edges per grind, cut tool costs still more, and practically eliminated all setup time after grinding.

In addition to having cut tool cost from \$2.09 to under 7 cents . . .

## Flash! Big Carbide Study Now Being Completed

A national survey of practices in industry in specifying, purchasing, and applying carbide tools is now being completed by WESSOR Company. Methods of reducing costs are included. If you want an advance copy of the findings, reserve your copy today. Write MARKET RESEARCH DEPT., WESSOR COMPANY, 1220 Woodward Heights Boulevard, Ferndale 20, Michigan,



WESSON COMPANY DEPT. AD 1220 Woodward Neights Blvd., Detroit 20, Mich.

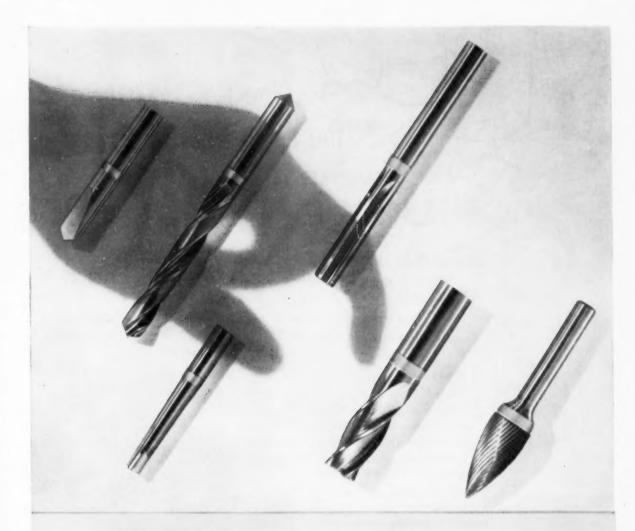
WESSON CUTTING TOOLS, LTD.

3 Production per hour was practically doubled—without changing feeds, speeds or depth of cut.

Annual savings on this one job: \$7200.00!

### Here are the figures:

,	Before	After
Cutting speed, sfpm	275	275
Feed rate per rev.	.017	.017
Depth of cut, max. in.	36	36
Machining time, mins.	61/2	61/2
Tool change time	5	5
Pieces per hour	21/2	5
Pieces per tool change	15	40
Pieces per grind (all edges)	30	320
Pieces per tool/insert	120	2560
Grinding cost per tool	\$27,00	\$12.00
Initial tool cost	\$79.77	\$55.28
TOTAL TOOL COST PER PIECE	\$2.09	\$0.066
Annual savings/machine		7200.00



### IT'S EASY to put your finger on the right ELGIN tool

End mills, drills, reamers, and burs-you'll find the one you want easily in the complete Elgin line. They're all grouped for quick reference in Elgin's new tool guide, "Tooling for the Future"-along with useful formulas, helpful tips, and handy charts we know you'll like. You'll like the production performance of Elgin tools, too. They're all solid carbide . . . guarantee longer runs, higher production, lower costs. Send for "Tooling for the Future" today.

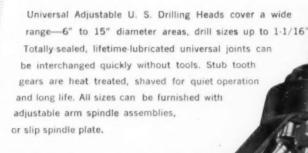
NEW TOOL GUIDE SIMPLIFIES CHOICE





## UNIVERSAL ADJUSTABLE U.S. Drill Heads

"Shot gun accuracy" is for the birds. With U. S. Heads you pin-point your multiple-hole drilling exactly—position the drilling spindles for different patterns almost as easily and quickly as you read them from your prints. U. S. Drill Heads are fast, sturdy, long-lived and require only minimum maintenance—cut down expensive re-operating cost, too!



Immediate delivery on most sizes.

Write today for complete
specification data in
new catalog

No. AD-57.

Style U-1L Universal Adjustable Head provides 9" diameter drilling area.

FOR MEN WHO KNOW DRILL HEADS
BEST, IT'S ALWAYS U.S. DRILL HEAD...5 to 1.



We manufacture all types of adjustable, fixed center and individual lead screw tapping heads. Ask us to help solve your multiple drilling and tapping problems.

UNITED STATES DRILL HEAD CO.

BURNS STREET . CINCINNATI 4, OHIO

CHOICE OF BUILT-IN
VALVES GIVES
CONTROL FLEXIBILITY

SINGLE AIR
CONNECTION
SIMPLIFIES INSTALLATION

Four reasons why
THE BELLOWS
AIR MOTOR
stands first with

tool engineers

RUGGED CONSTRUCTION ASSURES LONG LIFE

125 BELLOWS SALES AND SERVICE FIELD ENGINEERS

There are one or more Bellows Field Engineers in every industrial area of the United States and Canada. They will be happy to work with you in applying "Controlled-Air-Power" to your machine designs. They are listed in their local phone directories under "The Bellows Co."

758-8

In designing for air cylinder operation the engineer wants first of all sure, positive control, easily interlocked to related machine movements. He has it in The Bellows Air Motor.

He wants simple installation, uncomplicated by cumbersome piping.

He has it in The Bellows Air Motor.

He wants rugged construction — an air cylinder that will stand up day in and day out with minimum requirements for service and repairs. He has it in The Bellows Air Motor.

But he also wants the knowledge, if service should ever be needed, that it is quickly available wherever his machine may go.

He has it in The Bellows Air Motor.

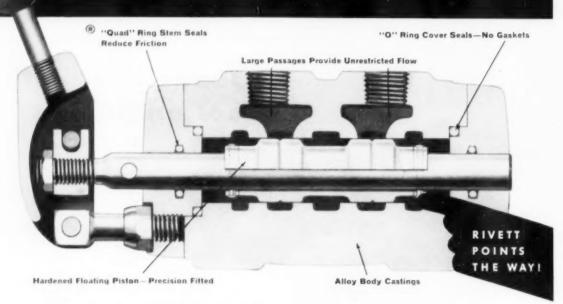
### The Bellows Co.

AKRON 9, OHIO



This free booklet offers interesting data for the design engineer. Write for it today. Address Dept, TE-1057. Ask for Bulletin BM-25. The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd.

# No Stick! No Bind!



### -with Floating Piston!

Valve Stem is Independent of Valve Bore in Rivett Hydraulic Pipe Mounted Valves

### Other Fine Features Benefiting Your Circuit Design and Operation

- · "Quad" Ring Stem Seals Reduce Friction
- · Large Passages Provide Smooth, Full Capacity Flow
- Simple Design Assures Leakproof Operation
- · Opens And Closes Smoothly, Positively
- Operates Multi-Million Cycles At 1500 P. S. I.

RIVETT, INCORPORATED . Dept. TE-10 Brighton 35, Boston, Mass.

### 1607 VALVE SELECTIONS!

Types: Hand, foot, cam, solenoid, pilot, oil pressure, air pressure, flow control, check, deceleration, relief, unloading, sequence, counterbalance.

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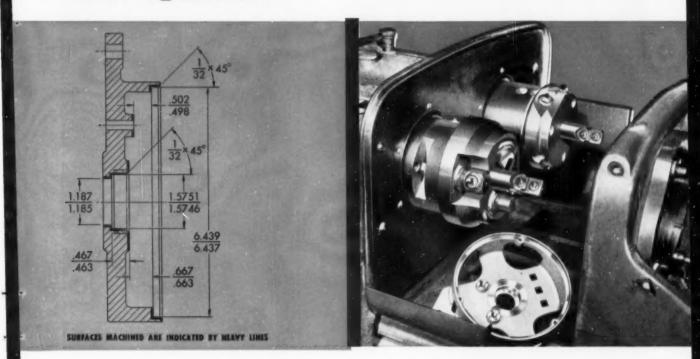
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### 9 surfaces rough and finish machined in 2 passes...



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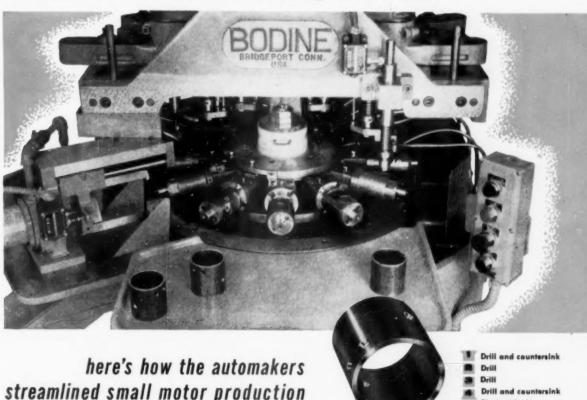
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### **Boding** case history no. 44



streamlined small motor production

ON BODINES

This Bodine Case History is really only one of many closely related installations in the key auto-electrical plants. The fact is that essentially ALL the small motors that power windshield wipers, window lifts, heaters, seat adjusters, etc., on today's cars are made this way . . . and on Bodine machines.

Parts being made on this 42-30 Bodine are tubular motor frames. On the production line, tube sections are conveyor-fed and held as shown on horizontal automatic indexing fixtures. After machining, they are automatically ejected by the stripper mechanism shown at the left of the machine, while special carbide inserts designed into the fixture remove inside burrs.

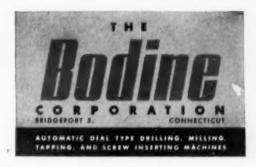
In the photograph above, auto-loading conveyor and locking mechanisms have been removed to show tooling.

Simple, rugged Bodine VERTICAL tool spindles drill and countersink two holes and drill two additional holes through the walls of the tubing, as shown in the diagram . . . all accurate within close limits for position and angularity. The same machines can be quickly re-tooled for changes in motor sizes on yearly models. Similar Bodine machines (case histories on request) process the motor pole pieces, commutators, gear housings and end plates . . . Bodine speed and low-cost efficiency ALL the way.

PRODUCTION on this machine, with its specially designed electronic programming motor on the main drive to cut every second of idle time, is 675 pieces per 50-minute hour.

If you have a production job on which you, too, want to aim for an entirely new standard of cost-quality-volume efficiency, send drawings and samples to Bodine.

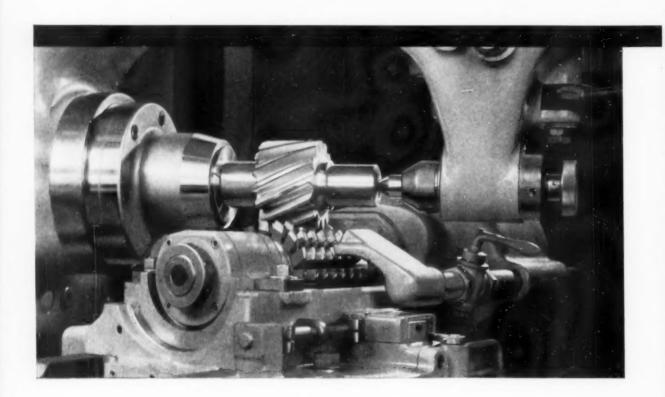
**Ejects** stripping



39067

crown

saves
time
and
cost
in
producing
accurately
crowned
gears



Crown-hobbing on this special Barber-Colman No. 14-15 Hobbing Machine is an ideal production method of generating crowned gear teeth. Where gears are now hobbed and then crown-finished in a secondary operation, they may be crown-hobbed in one operation. When a hobbed finish is satisfactory, the shaving operation can be completely eliminated. If the degree of finish required calls for a further finishing operation, such gears may be finished after crown-hobbing at less cost and in less time because hobbing provides uniform stock removal.

Crown-hobbing also makes it possible to hold a change in tooth thickness within the desired limits, and the tooth bearing can be located at the most desirable point consistent with the job conditions.

In the operation shown here, 4 DP., 14T, 18° P.A. transmission gears with 2¾" face are crown-hobbed on a special Barber-Colman No. 14-15 Hobbing Machine. Teeth are hobbed with a change in tooth thickness of .0045". The automatic cycle includes rough hobbing R. to L. at a given depth, automatic lowering of the work slide against the crowning cam, climb hobbing L. to R. at a constantly changing depth, and rapid traversing out of cut. No further finishing is required in this particular case, and the gears are completed in one automatic operation, without changing tools or transfer to other machines. Savings on this part can be expected on the basis of the following comparison:

### typical gear-crowning

### Rough hob gear teeth. Transfer to other machine. Semi-finish hob gear teeth. Transfer to next machine. Crown-finish gear teeth.

### crown-hobbing

Manually unload and load.
Automatic cycle — rough hob.
R. to L., set to finish depth,
and crown hob L. to R.
Manually unload and load.

The machine can be designed to suit your job requirements, either as a single-purpose machine, or as a universal machine for both crown and conventional hobbing. Parts can be hobbed in one or two cuts, depending upon specifications of the part. The cam can be designed to produce the tooth configuration required.

The machine required for crown-hobbing is provided with a cam mechanism for raising and lowering the work slide to produce a change in tooth thickness. The work slide is held against the rotary cam by hydraulic pressure in addition to its own weight. Change gears are provided in the cam drive so that different amounts of change in tooth thickness can be produced with the same cam.

Send us drawings of your crowned-gears. Our engineers will analyze the job conditions and make recommendations for crown-hobbing.

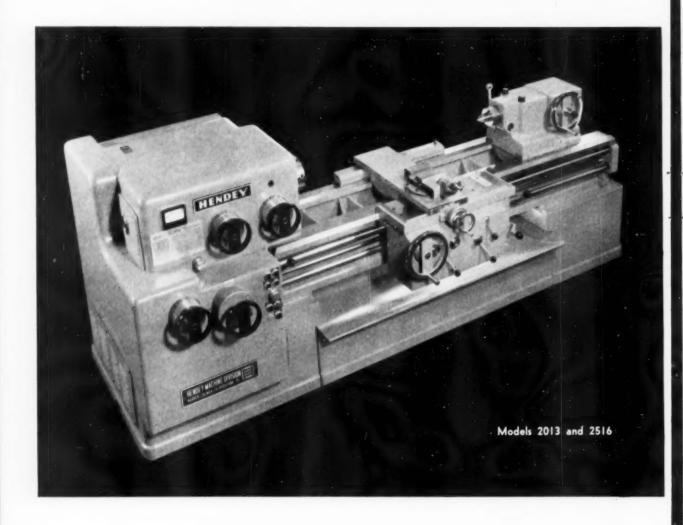
### BARBER-COLMAN COMPANY

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Hobs . Cutters . Reamers . Hobbing Machines . Hob Sharpening Machines



# NOW! FROM HENDEY... all new 32-speed



More rigidity, more threading features, more lathe per dollar!

### geared-head lathe

Here are the all-new Hendey No. 2013 and No. 2516 lathes, with a 32-speed geared head (up to 2000 rpm), a complete line-up of threading features, and heavy-duty design combined with toolroom precision. The 32-speed headstock transmission contains crowned, flame-hardened spur gears which are automatically lubricated. You select speeds simply by shifting gears. Greatly simplified mechanical design gives you lower maintenance costs—more machine, dollar for dollar, than any other lathe in its class.

Three sets of super-precision tapered roller bearings support the spindle at both ends and in the middle, increasing accuracy and improving finish. An automatic spindle adjuster eliminates any manual adjustment of the spindle bearings regardless of the spindle speed.

The extra-heavy bed casting is made of dense, wear-resistant semi-steel, which is induction-hardened and ground on all way surfaces. Lathes can be furnished with a 15, 20, or 25 hp spindle drive motor and come equipped with a load meter and automatic overload release for the carriage feed.

Hendey has all the threading features, including: (1) multiple-thread indexing spindle, (2) built-in thread-chasing dial, (3) 66 feed and thread changes, with 2 to 120 quick-change threads per inch and feed range from .0015 in. to .091 in. per revolution, (4) reverse lever on apron, (5) automatic micrometer stops, (6) ball-thread-chasing stop on cross-feed screw, (7) hardened and precision-ground cross-feed screw and compound screw, (8) automatic, filtered lubrication to the half nuts.

Compare these tailstock features with other lathes on the market: Weighing almost 400 lb, the tailstock can be positioned quickly and easily with one hand. And the ways under it are hardened and ground. Large 4½ in. diameter spindle has a full 10 in. extension, with slow and rapid traverse speeds.



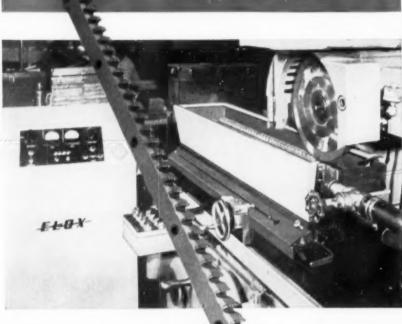




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103 Loomis St., Rockford, Illinois







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preformed carbide blanks\$	32.00
Omitted operations savings	120.00
Diamond wheel savings	142.00
Sums up to	294.00

Broach, used for broaching the pine tree form on turbine blades of the J-57 Jet engine.

### NO DIAMOND WHEEL...

EDM substitutes inexpensive brass wheels costing less than \$45 for expensive diamond wheels costing a minimum of \$150. Brass wheels are formed for \$1 as against a diamond wheel contour forming cost of \$35.

## NO PREFORMED CARBIDE BLANKS...

Conventional machining necessitates preformed tungsten carbide and preformed steel shanks. EDM machines the carbide, brazing material and steel simultaneously, and requires no indexing to assure a perfectly formed broach as to location and size.

### OPERATIONS ...

Conventionally machined, the pine tree broach requires 22 operations. EDM does it better in 14.

Electrical Discharge Machining has reduced the machining time of this intricate form in 32 carbide tipped teeth to a total time cycle of 33 minutes . . . one-half the time of abrasive grinding. Tolerances held to: +0, -.0002".

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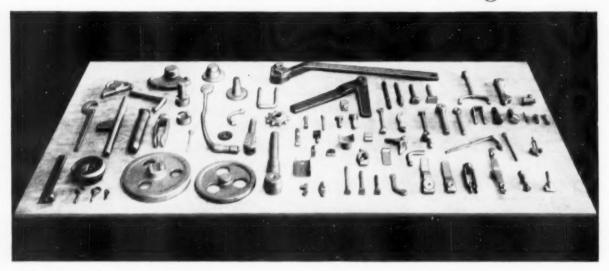
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Better, Faster and at Much Lower Cost

with TOCCO\* Induction Heating



 When progressive production people at General Railway Signal Company installed a 200 kw, 3000 cycle TOCCO machine, they were able to eliminate 7 slot-type oil-fired furnaces and produce better forgings than ever before—at substantially lower costs.

**Cost Down**—Fuel costs have been reduced from \$15.26 to \$1.60 per hour with TOCCO. Expensive furnace lining maintenance has been eliminated, and straightening and reheating operations formerly required are no longer necessary.

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### A Step Up

Professional advancement comes to the tool engineer who is ready for it. An engineer who has prepared himself with an engineering degree or through experience has made the first step. He can and must further prepare himself for greater responsibility. The manner in which this is done is up to the individual.

Preparing for new responsibilities can be accomplished through formal or informal training. Night courses relating to tool engineering are available in most cities. For those who cannot attend night school, home-study courses have been prepared. Informally, the individual tool engineer can effectively broaden his scope, and thus his value, by reading publications containing information on his profession.

Another effective, informal path to the professional knowledge required for advancement in tool engineering is through the American Society of Tool Engineers. The main purpose of ASTE is to gather and disseminate the technical information of tool engineering. Its technical sessions are informative and educational. Contact with others in the same profession leads to the interchange of ideas to the benefit of all.

Those who actively participate in Society activities have a splendid opportunity for getting invaluable training in leadership, a prerequisite for advancement to the top. A position of leadership in the Society will introduce the tool engineer to a different awareness of costs and economics. Since tool engineering is cost consciousness—as well as knowledge of production methods—any new points of view are good.

If a tool engineer analyses his present position, he will note that advancement has come only after he was recognized to have leadership qualities, professional proficiency and the ability to get along with people. The stairway to success must be taken a step at a time. With each step must come more knowledge, more confidence and more initiative.

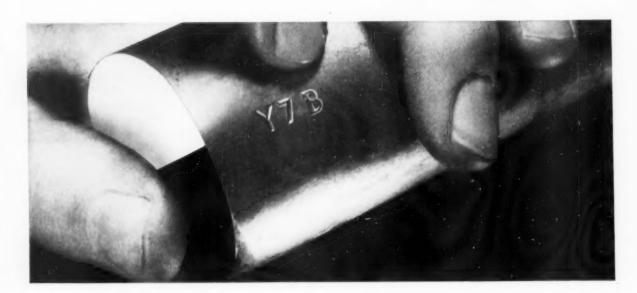
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For more information about Ryerson alloys and the Ryerson Certified Alloy Steel plan, call your nearby Ryerson plant.

Principal products: Carbon, allay and stainless steel — bars, structurals, plates, sheets, tubing, industrial plastics, machinery and tools, etc.



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# developing

### for manufacturing management

By John A. Ritchey

Associate Professor Industrial Management Purdue University Lafavette, Ind.

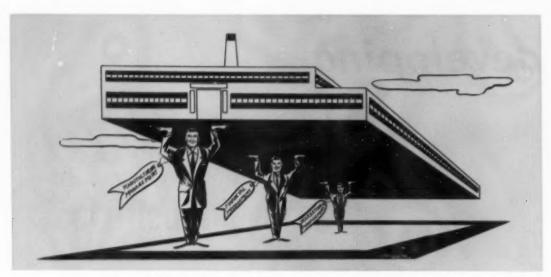
There is a place for engineers in management, and the need for men with technical backgrounds is growing. What qualities and what kind of self-development are needed for management are described in this article by a nationally recognized authority.

Successful industrial organization, like a three-legged stool, rests on three main components. These are finance, manufacturing and marketing. Financing operations start the organization, manufacturing operations produce the product and marketing operations sell the product. If any one of these operations weakens or collapses, then the whole organization collapses.

To prevent collapse of the enterprise or even a lessening of its most effective performance, all three of these components must be equally well managed and must be coordinated to work smoothly together. Such an achievement is not a matter of chance.

Though one speaks in the abstract about "good management" of finance or of manufacturing, in actual fact the reference is to the individual efforts and abilities of persons responsible for these functions. The success or failure of any concern depends to a great extent, if not entirely, on the people it has placed in responsible managerial positions. Not only its current success but its future greath as well depends upon competent managerial personnel. One Eastern manufacturer recently delayed an expansion program upon his realization that the firm lacked sufficient managers to handle the expanded facilities. His previous experience of having placed unqualified people in managerial positions had been too costly to risk again. This executive's experience has been duplicated in dozens of other concerns-particularly in the area of management of manufacturing.

Manufacturing activity today has become so complex and so technical that companies can no longer get by simply by promoting some of their better workers to the level of management. It is necessary to procure and develop people capable of taking over and managing the various phases of



Successful industrial organization is supported by manufacturing, finance, and marketing. All three types of management are vital.

manufacturing operations. Disaster can overtake an enterprise while it waits for a competent manager to turn up, whereas a deliberate plan of managerial development can insure its increasing growth and success.

There are a number of general principles of management which appear to be useful to the manager whether he has charge of a foundry, a machine shop, woodworking plant, or a chemical plant. These principles deal with the science of management, rather than the science of casting metal, grinding bearings, gluing plywood or making synthetic rubber. It would seem, therefore, that a successful manager of a foundry could be equally successful at managing a woodworking shop. To a certain extent this is true. But why is it not 100 percent true?

The main reason industrial managers do not transfer successfully to other organizations is the technical ability required on the different jobs. Though a man may possess high managerial ability of wide application, his limitations in technical knowledge keep him from making progressive changes in managerial positions in varying industrial enterprises or within any one industry.

The engineer, however, has an advantage in this area of technical competence. Not only has he technical ability by virtue of his education and experience, but he has no fear of new or unfamiliar technical problems that may arise. He is equipped with a number of basic scientific and analytical tools which give him confidence in attacking the unknown. When managerial ability is added to this broad technical ability, the result is a manufacturing manager capable of handling the complex problems of modern manufacturing establishments.

This is not to imply that all engineers should be managers or that it is impossible for a nonengineer to be a competent manufacturing manager. The point is that the engineer, if interested in managerial work, is peculiarly qualified for it from a technical ability viewpoint. Companies do well to examine engineers as a source of managers. Though it is equally true that engineers have their limitations, as does everyone, and not all are potential managers, the contribution of many engineers to the company might be enhanced by a movement into managerial work and away from straight design.

Now, what about managerial ability referred to earlier? The engineer's strong points are generally considered to be the handling of problems on a strictly objective basis and a great sense of integrity in his work. This means that the engineer designs a tool to do the job specified and is willing to submit all details of his design to any competent judgmental body without fear of criticism. To an engineer, all problems have solutions that can be reached in a straighforward objective manner.

When it comes to managerial work, however, this asset or quality may become a liability, for most management problems do not lend themselves to detailed objective analysis and solution, at least at the present state of this developing art. There are no sets of laws, formulas, or rules that apply to people in the way they apply to metals or machines. People are seldom predictable; they are often difficult, and they are always different. When confronted with the problems inherent in the handling of people, the engineer may be thrown into a tailspin and wish he were back at his drawing board dealing with inanimate objects.



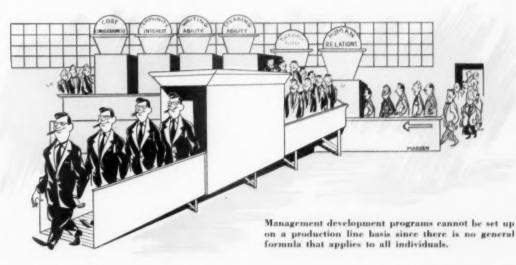
Basically then, good managers are people-oriented rather than thing-oriented. Traditionally engineers are thought of as being strictly thing-oriented. This is not always true, however, and it is the people-oriented engineers who can be developed into a highly competent breed of managers. These are the engineers who prefer to work with others rather than alone, who join and take part in organizations, who lead reasonably active social lives and who are community minded.

Developing such engineers into managers represents an excellent example of the frustration and challenge of the people-problem referred to previously. In this situation certain general principles should be emphasized.

First, there is no general formula or plan for

managerial development that will work in all situations. Recently an inquiry from a company asked for a training program that would make managers out of their engineers. Upon investigation it was learned that they had read somewhere about management development programs and decided they should have one too. They assumed they could install one and get results from it the same as if they had installed a new machine tool.

The next principle is that development programs do not do the job of developing the individual in themselves. All development is self-development. The company can only make available to the trainee certain facilities, programs and experiences which will allow him if he is really interested to broaden himself to the point where he has confidence and



ability in handling managerial problems. If he fails to avail himself of these opportunities, there is little that the company can do to develop him. It is entirely a matter of motivation for self-development.

A third principle is that such development aids should be oriented toward the individual. This agrees with the first principle that decries the use of packaged programs. The self-development opportunities offered to any trainee should be based on his individual needs, rather than following some canned procedure. This does not mean that if several trainees need development in communications skills, they should not take a course together. It does mean that a company should not force all



Management development basically is self-development and depends on the individual's own interests, abilities and motivation.

trainees to take a course in communications skill simply because it might do some of them some good.

Some companies seem to make a practice of looking around for various programs and courses through which they can put their management trainces. Their philosophy appears to be that of assuming they have standardized people whom they can put through standardized programs in order to achieve standardized managers.

In placing developmental programs on an individual basis, personal guidance and appraisal of the trainee in most important. This is the responsibility of the trainee's supervisor, but is often overlooked. As the trainee moves along from one assignment to the next, it is essential that he know how he is doing. What were his weak points, and what were his strong points on each assignment he tackled? He not only deserves to know, he needs to know in order to continue the process of self-development on future assignments.

This does not need to be a formal process of evaluation with rating forms and weighted factors. It does need to be regular and sincere appraisal in conditions of privacy and unhurried atmosphere so that a complete understanding is achieved between trainer and trainee concerning the expectations and performance of the engineer during his managerial training.

The fourth and last principle to be included is that managerial development should be centered around the engineer's present job. This assumes, of course, that the engineer has been moved from strictly technical work into a job involving some management duties and responsibilities, if only at a low level. For example, he may be supervising the work of several draftsmen; he may have charge of installing equipment involving the services of several mechanics or he may have recently become foreman of a production department.

If the developmental program is aimed at improving his performance on the present managerial task rather than at the job it is hoped he will be able to perform 10 to 20 years hence, everyone concerned is better satisfied. Doing a superb job with today's assignment should be the goal of the development program and advancement should be of secondary importance. Promotions will follow if they are earned and when they are available.

This article has attempted to show how the engineer, with his technical background, is peculiarly well qualified as raw material for manufacturing management work, provided he gives evidence of being people-minded rather than thing-minded. It has outlined some useful principles that should be applied when launching any kind of a managerial development program for engineers. In general, these principles suggest that each individual trainee should have the benefit of a program that assists him personally in improving his performance on his present managerial job.

The discussion has not been concerned with the content of any individual program other than to emphasize the great importance of people in the management situation. Management is often defined as the accomplishment of goals through people. A thorough understanding and appreciation of this definition on the part of the engineer would be one of the goals of his developmental program. Though used to doing the job himself, an engineer must be made to realize that a true manager works through and with others in order to get things done. This realization, coupled with his basic technical ability, can lead to great managerial achievements for the engineer in today's complex industrial world.

# liadgets-

Ingenious Devices And Ideas To Halp

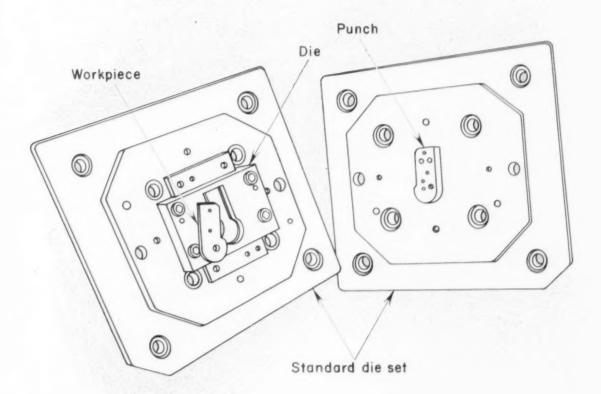
The Tool Engineer In His Daily Work

### Low-Cost Die

When production requirements for a stamping are low, tool engineers are often faced with the problem of designing an economical die. This was the case with a small blanked part, made from ½-inch-thick aluminum. The simple die illustrated, machined from ½-inch-thick steel, cost much less than a Class A die for the same part and is used with a standard die set.

Normally, stripping the part with cork or rubber strippers would not be a problem; however, it was found that owing to the thickness of the aluminum the part would not strip from piercing punches. In order to avoid the cost of a special stripper, it was decided to drill rather than pierce the three holes. Prick punches were inserted in the upper die and the marks indented in the blank serve as locating points for the drilling operation. These locating points greatly expedite drilling.

Paul L. Krueger Philadelphia Chapter



### Multipurpose Fixture\*

Accurate but inexpensive tooling is needed for low production. In this type of work, economies can be effected by designing one tool or fixture to do the work of several.

The stainless-steel part illustrated presents an interesting problem. Both faces must be ground perpendicular to the bore. There are three milled slots in the periphery of the workpiece, one of which must be ground to close tolerances, and there is also a milled slot in one of the faces of the workpiece. There are five drilled holes, two of which are counterbored, and four endmilled holes.

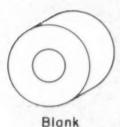
Because of low volume requirements it was not considered practical to perform these operations on a special machine tool. Accordingly, standard machines are utilized. A single holding fixture serves as a drill jig as well as a milling and grinding fixture. As shown in the exploded view, the fixture consists of a steel body equipped with several accessories. Squareness of the body facilitates location for all operations. For most operations, the part is held by a washer screwed to a locating post. Since the locating post is equidistant from all sides of the body, the body can be "flopped" for different operations without affecting machine settings or stops.

Drill bushings are held in removable blocks ground to fit accurately located slots in the tool body. A tongue on the end of one of the drill bushing blocks orients the part for the majority of operations. An indexing pin orients the part for drilling holes in the periphery at an angle of 45 degrees to the slots. The bushing blocks serve as a means of clamping the part for operations where it cannot be held by the clamping screw. A third bushing block for locating three holes in the face of the part is inverted for drilling one of these holes, since the holes are too closely spaced for safe bushing wall thickness.

The fixture has been successful in production. It produces accurate parts, is simple to use and can be easily changed over for different operations.

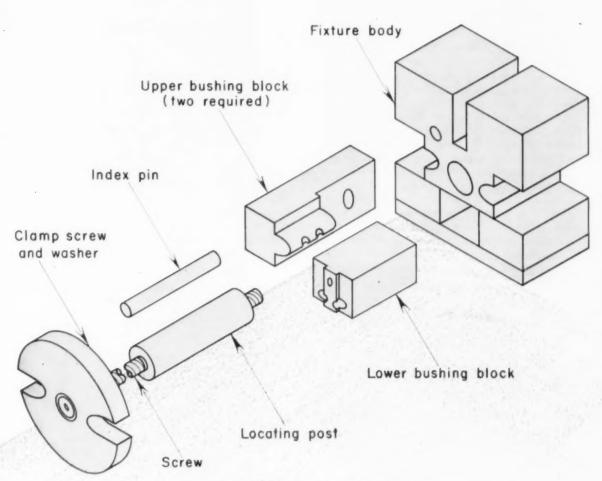
> Robert Daly San Fernando Chapter

\*Gadgets Contest Entry



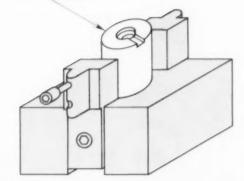
Finished Part

# Gadgets

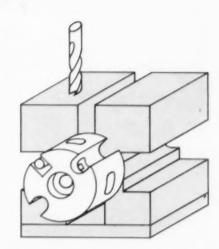


Exploded View of Fixture

Workpiece



Operation: Grind Two Faces-Mill One Slot



Operation: Mill Four Holes (Clamp not shown)

# Gadgets

### **Turning Fixture**

When machining complex workpieces, it is desirable to plan the work so that as many operations as possible can be performed on one machine, in one fixture. The fixture shown was designed to permit several turning operations to be performed on the teeth of a special milling cutter.

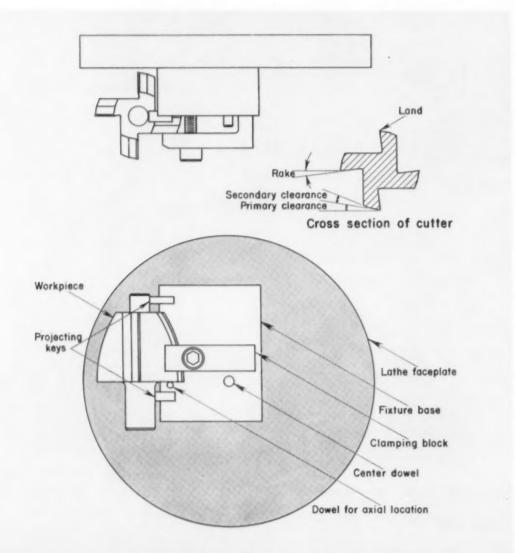
The base of the fixture consists of a block, which is tapped to permit it to be secured to the faceplate of a lathe. A dowel pin in the fixture base is located so that when the fixture is in correct position, the pin is at the exact center of the faceplate. Two projecting keys are welded to the block and then accurately ground to serve as locators for the work-piece. The workpiece is positioned axially by a second dowel pin.

Previous operations on the workpiece are: turn the shank and pilot diameter, rough out the teeth and rough mill the flutes. The flutes are milled at a 90-degree angle, since the rake angle can readily be cut in the final turning operation. With preliminary operations accomplished, the workpiece is clamped on the turning fixture as shown.

Turning the circular land is the first operation. Then primary and secondary clearance angles are cut, after setting the lathe compound at the correct angles. The compound is set at a third position for face-cutting the rake angle.

Measuring the radius of the cutting edge is accomplished by "miking" across from the cutting edge to the center dowel and subtracting one-half the dowel diameter from the resulting measurement. While the design of the workpiece is somewhat unusual, this method of fixturing may be applicable to other jobs encountered in toolroom work.

> Ernest Jones Bronx, New York



### how to determine

### **Production Tolerances**

### Part One-complete interchangeability

By Karl H. Moltrecht\*

and

#### Robert M. Caddell\*

Assistant Professors of Mech. Engineering University of Michigan Ann Arbor, Mich.

Of daily concern to the tool engineer are the problems involved in safely increasing tolerances to reduce machining costs. This article describes a scientific method for attaining this desirable goal which requires only a minimum of mathematics.

Tolerances are a recognition of the fact that dimensional perfection cannot be achieved. Although modern machine tools are capable of machining to high levels of accuracy, their ability to duplicate a specific dimension on a repetitive basis is still limited. Temperature changes, tool wear, deflections and vibrations of the machine and the work—in addition to human errors—are inherent in the machining of any part. The influence of these factors precludes the exact duplication of size. Most mechanisms will function satisfactorily when the

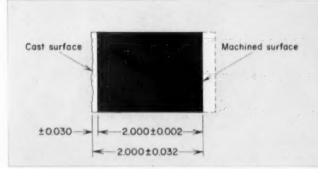


Fig. 1. Simple cast part with machined surface represents a common type of production tolerance problem.

permissible variations of the individual components are defined. Tolerances are the permissible variations.

In the design of a product the emphasis is on function, and an unawareness of production difficulties often leads to the application of tolerances that are difficult to attain economically. In the shop the emphasis is on ease of production. The necessity of close tolerances is often not appreciated. These different points of view must often be resolved by the tool engineer. It is hoped that these articles may shed some light on the subject of tolerances by discussing some of the aspects of tolerance control available to the tool engineer.

### Factors Affecting Tolerance

Perhaps in some remote areas, fits between mating parts are still being made by matching together 1D and OD calipers. Certainly this practice has

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no place in modern American mass production.

The primary purpose of tolerance is to assure the correct functioning of mating parts in a structure or a mechanism. That manufacturing costs are decreased by the application of tolerances is sometimes questionable, especially if tolerances are misapplied. In order to realize lower manufacturing costs, the maximum allowable tolerances consistent with interchangeable assembly should be applied to the part.† By decreasing the assembly costs and

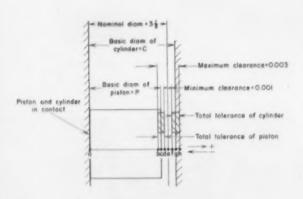


Fig. 2. Schematic drawing of piston and cylinder assembly with points, a, b, c, d, e, f, g and h on line of diameters.

assuring a constant flow of the finished product to the market, correctly applied tolerances lead to economical manufacturing.

Determining Drawing Tolerances: The design engineer, guided by theory and practical experience, determines the allowances and the tolerances of mating parts from a functional point of view. His ideal fit may be unattainable except at excessive cost. In this situation the tool engineer may be in a position to be of assistance.

To select tolerances from the tool engineering point of view the following factors should be considered:

To select tolerances from the tool engineering point of view the following factors should be considered:

 Functional requirements of the part are of prime importance

†For Tolerance Charts see THE TOOL ENGINEER, May 1957, p. 121; Dec. 1956, p. 95 and Feb. 1954, p. 89.

- The part must be manufactured at a reasonable cost, which implies that the tolerances should always be as large as permissible
- Machine tool and the process capabilities must be recognized
- A decision must be made regarding the type of assembly to be used
- Manufacturing processes for production of the part should be analyzed. Reference or locating surfaces should be determined and tolerances applied from these surfaces.
- Stock allowances for machining and other operations should be determined and specified.

Machine Capabilities: Individual machine capabilities can best be determined by actual test on the machine which is to perform the operation. The condition of the machine, skill of the operator, size and shape of the part, and condition of the tools all have an influence. It is well to consult shop personnel or representatives of machine tool builders for help when the problem is particularly difficult.

When considering machine capabilities the limitations imposed by the reference or locating surface must be taken into account. For example, in Fig. 1, the machining operation has the capability of producing surfaces to a tolerance of  $\pm$  0.002 inch but the part is located from a cast surface having a tolerance of  $\pm$  0.030 inch. The tolerance resulting from this operation cannot be better than  $\pm$  0.032 inch.

### Effect of Assembly Operations

The type of assembly operations to be used, taken together with economic machine capabilities, production rate required, sequence of operations, and functional requirements of the part, form the basis of the selection of tolerances. Hand assembly operations, where hand fitting of parts by skilled labor is done, can result in work of the highest quality, as in the scraping of machine tool ways. This approach, however, is slow and expensive in terms of the over-all cost of the product. It does often allow machining tolerances to be opened up, thus reducing machining time and machining cost.

Interchangeable assembly is the goal of most modern production plants. When perfected, this method of assembly assures the lowest possible assembly cost and a controlled flow of the finished product from the plant. Even though it often requires smaller tolerances, the over-all economic gain in cost cases overrides the increased machining cost often associated with this approach.

Interchangeable assembly can be obtained by a careful analysis of the tolerances of the parts which are to be fitted together. There are three distinct methods of analysis for interchangeable manufacture. These can be termed:

- J. 100 percent interchangeability
- 2. Statistical average interchangeability
- 3. Selective assembly.

The first topic, 100 percent interchangeability, will be discussed in this article. Statistical average interchangeability and selective assembly will be the subject of the second part of the series which will appear next month.

### Tolerances for 100 Percent Interchangeability

A simple and convenient method for analyzing tolerances is the path equation. Due to its simplicity it is often overlooked. Its advantages can best be illustrated by some examples.

Tolerances and the basic diameters of a piston and cylinder are to be determined. A schematic drawing of the assembly is shown in Fig. 2. Functional specifications require that the nominal diameter of the assembly should be  $3\frac{1}{2}$  inches and that the maximum and minimum total clearances between the piston and cylinder should be 0.003 inch and 0.001 inch respectively.

For purpose of analysis by the path equation, the sketch of the assembly should show the surfaces of the cylinder and the piston in contact at one side as this simplifies the writing of the equation. In writing the equation, either direction, right or left, can be taken as positive and the other direction negative. As shown in the sketch, Fig. 2, right is taken as positive, left as negative. Letters a, b, c, d, e, f, g, and h represent geometric points: a is one side where piston and cylinder are in contact, b is opposite wall of minimum size piston, c is opposite wall of basic size piston, d is opposite wall of maximum size piston, e is opposite wall of nominal size cylinder, f is opposite wall of minimum clearance cylinder, g is opposite wall of basic size cylinder, and h is opposite wall of maximum size cylinder.

First, the tolerances are determined starting at b:

$$+ \overline{bd} + \overline{de} - \overline{be} = 0.....$$
 (1)

Where

 $\overline{bd}$  = tolerance of piston

 $\overline{de} = \text{half of the minimum clearance} = \frac{i}{2} (0.001)$ 

 $\overline{bc} = \text{half of the maximum clearance} = \frac{1}{2} (0.003)$ 

Thus

$$+\ \overline{bd} + \frac{0.001}{2} - \frac{0.003}{2} = 0$$

Tolerance of piston =  $\overline{bd}$  = 0.001 inch

Likewise, where

 $\overline{fh}$  = tolerance of cylinder

Then

$$+ \overline{fh} - \overline{eh} + \overline{ef} = 0$$

$$+ \bar{t}\bar{h} - \frac{0.003}{2} + \frac{0.001}{2} = 0$$

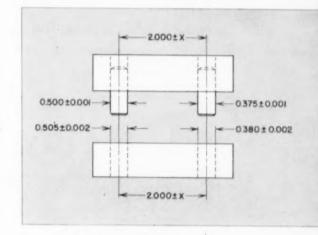
Tolerance of cylinder  $= \overline{fh} = 0.001$  inch

Now to determine the basic diameter of the piston the following equation is used

$$+\overline{ae}-\overline{ed}-\overline{dc}-\overline{ca}=0$$
 .....(2)

Where

ae = nominal diameter of piston = 3.500 inches



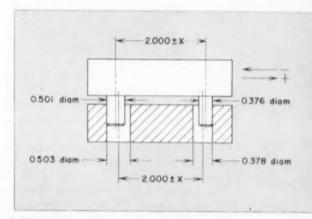


Fig. 3. Sketch of simple assembly, (a) pins in one part must mate with holes in second part; (b) extreme condition with maximum size pins and minimum holes, pin center distance maximum while hole center dimension is minimum.

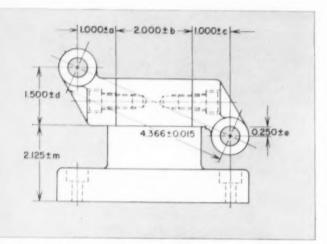


Fig. 4. Bracket assembly representing a typical production tolerance situation.

ed = half of the minimum clearance = 1/2 (0.001)

 $\overline{dc} = \text{half of the piston tolerance} = \frac{1}{2} (0.001)$ 

ca = basic diameter of the piston

Thus

$$3.500 - \frac{0.001}{2} - \frac{0.001}{2} - ca = 0$$

Basic diameter of piston  $= \overline{ca} = 3.499$  inches

The equation for the basic diameter of the cylinder

$$+ \overline{ae} + \overline{ef} + \overline{fg} - \overline{ga} = 0$$

$$3.500 + \frac{0.001}{2} + \frac{0.001}{2} - \overline{ga} = 0$$

Basic diameter of cylinder = ga = 3.501 inches

The piston and cylinder specifications now are

Piston = 
$$3.499 \pm 0.0005$$
 inch  
Cylinder =  $3.501 \pm 0.0005$  inch

Although this problem is a simple one, it illustrates the application of the path equation. A somewhat more complex problem is illustrated in Fig. 3. Sketch 3a shows two parts which must be assembled as in sketch 3b. The center distance tolerance for the holes and the pins is to be determined. In solving a problem of this nature the extreme conditions that still allow assembly must be visualized. In this case an extreme condition occurs when two large pins encounter two small holes, and when the pin center distance is maximum while the hole center distance is minimum. Starting at the center of the left pin, the following path equation can be written:

$$\frac{-0.501}{2} + \frac{0.503}{2} + (2.000 - x) + \frac{0.378}{2} - \frac{0.376}{2}$$
$$- (2.000 + x) = 0$$

from which: X = 0.001 inch

Since the tolerances on the pins and holes are bilateral, the tolerances of both center distance are ± 0.001 inch. Thus

Another application of this method to a more complex assembly, Fig. 4, will illustrate a typical production problem. Details of the assembly are shown in Fig. 5. The tolerances a, b, c, d, e, and m are to be determined in order to maintain a tolerance of  $\pm$  0.015 inch for the center distance of the two holes. A schematic drawing of the dimensions will be helpful in this analysis, which is shown in Fig. 6. Again the path equation is written, taking one direction as positive and the other direction as negative.

From Fig. 6

$$+A+B+C+D+E+M-(4.366\pm0.015)=0$$

To solve for A, B, etc., the inclination angle is

$$\tan \theta = \frac{1.75}{4} = 0.4375$$
 $\theta = 23^{\circ}.38'$ 

Now the values of A, B, C, D, E and M are found.

$$A = (1.000 \pm a) \cos 23^{\circ} 38' = 0.91613 \pm 0.91613a$$
 $B = (2.000 \pm b) \cos 23^{\circ} 38' = 1.83226 \pm 0.91613b$ 
 $C = (1.000 \pm c) \cos 23^{\circ} 38' = 0.91613 \pm 0.91613c$ 
 $D = (1.500 \pm d) \sin 23^{\circ} 38' = 0.60132 \pm 0.40088d$ 
 $E = (0.250 \pm e) \sin 23^{\circ} 38' = 0.10022 \pm 0.40088e$ 
 $M = (2m) \sin 23^{\circ} 38' = 0.80176m$ 

Substituting these values in the path equation,

+ 
$$(0.91613 \pm 0.91613a) + (1.83226 \pm 0.91613b)$$
  
+  $(0.91613 \pm 0.91613c)$   
+  $(0.60132 \pm 0.40088d) + (0.10022 \pm 0.40088e)$   
+  $(0.80176m)$   
-  $(4.366 \pm 0.015) = 0$ 

The equation may be written as follows:

$$0.91613 + 1.83226 + 0.91613 + 0.60132 + 0.10022$$
  
-  $4.366 + 0.80176m \pm 0.91613 (a + b + c)$   
 $\pm 0.40088 (d + e) = \pm 0.015$ 

By adding the distribution factors (4.366, 0.91613,

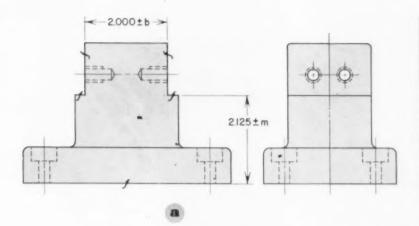


Fig. 5. Details of bracket assembly showing critical dimensions, (a) bracket base; (b) right-hand bracket; (c) left-hand bracket.

etc.) it is seen that they will cancel out except for a small quantity (0.00006 inch) which can be neglected since the center distance tolerance is  $\pm$  0.015 inch. In order to solve the equation two assumptions are made:

- Assume that the extreme conditions exist, i.e., all of the tolerances are plus (or minus).
- Assume that all of the unknown tolerances are equal to each other and set them equal to X in the equation.

The equation will now read:

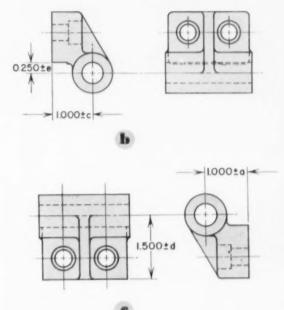
$$0.80176X = 0.91613(3X) + 0.40088(2X) = 0.015$$
  
 $4.35191X = 0.015$   
 $X = 0.00342$ 

If the tolerances, a, b, c, d, e and m are now specified to be  $\pm$  0.003 inch, the tolerance of the center distance of the assembly will always be within the required  $\pm$  0.015 inch.

The tolerances may now be distributed in either direction if so desired. Their sum, however, must not exceed the sum of the tolerances in that direction. For example, the tolerances a and c may be enlarged to  $\pm$  0.004 inch if the tolerance b is reduced to  $\pm$  0.001 inch. The sum of the tolerances in this direction must never exceed  $\pm$  0.009 inch.

In establishing the tolerance in the equation, 0.00042 inch was discarded as being, in this case, an impractical specification. It could be utilized to add  $\pm$  0.001 inch (3  $\times$  0.00042 = 0.00126) to any one of the tolerances a, b or c or  $\pm$  0.0008 inch to any one of the tolerances d or e. If added to tolerance m it cannot be more than 0.0004 inch  $(2 \times 0.00042 \times \frac{1}{2})$ . In this problem one tenthousandths inch tolerances are considered to be impractical.

The other methods of analysis, statistical average interchangeability and selective assembly will be discussed in a later issue.



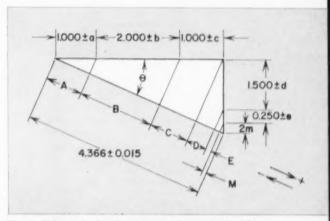


Fig. 6. Schematic sketch analyzing dimensional problems of bracket assembly shown in Fig. 4. Tolerances a, b, c, d, e, and m to be determined to give a 0.015 inch tolerance for center distance of holes.

# tool enquineeting

...for production of miniature parts

By Donald E. Zierk\*

Manager, Tool Engineering Elgin National Watch Co. Elgin, III

Many parts for watches are so small that hundreds can be contained in a thimble. Despite their small sizes, these parts are machined to close tolerances and parts handling and assembly operations are often mechanized. The author lists some of the important considerations in planning for the manufacture of miniature parts and describes a number of interesting operations in watch manufacture.

PRODUCTION OF MINIATURE PARTS and assemblies is a specialized field. From a tool engineering standpoint, however, the over all objectives are the same as in any other type of manufacture. Parts must be produced in the required quantities at the lowest possible cost and they must meet specified quality standards.

It is not too difficult to put 0.050-inch diameter wire into an 0.057-inch diameter hole; the 0.007-inch clearance creates no problems. A miniaturized version of the same assembly may have an 0.001-inch diameter wire fitting into an 0.0070-inch diameter hole, requiring different handling and manufacturing techniques. Going one step further, the components may be subminiaturized so that an 0.0004-

<sup>\*</sup>Senior member Fox River Valley chapter.

This material was presented—in different form—at the Third Annual Automation Seminar at Pennsylvania State University.

inch diameter wire is fitted into an 0.0011-inch diameter hole. With only 0.0007-inch clearance, handling and assembly methods must again be changed.

Tooling Considerations: When a product is miniaturized, close cooperation between product design engineers and tool engineers is essential. The specialized knowledge of the tool engineer is invaluable in determining machinery and equipment requirements and in evaluating manufacturing feasibility. In some cases, a relatively simple product design change will greatly simplify machining and handling problems; in other cases it may be advisable to redesign the product completely, rather than to miniaturize each component.

Specialized equipment for manufacture of miniature parts is not commercially available so it must be especially designed and built. To hold tooling costs down, it is important to consider the possibility of utilizing existing equipment for new products.

The approximate sizes of parts which can be handled can be roughly determined by selecting the smallest precision part currently being made, and determining how many of these parts can be fitted into a given space. At Elgin, for instance, nearly 140 such parts, Fig. 1, can be contained in a one-inch cube. Present equipment and methods are geared to this size base and when new parts are designed to the same size base, they can be produced without extensive retooling.

In addition to part size, there are two other considerations which are important in planning for the manufacture of miniature parts. The first of these is product volumes. The length of a production run determines, in large measure, whether or not automatic handling will pay. For short runs, tooling is kept as simple as possible. Longer runs often justify the installation of automatic machine loading and unloading devices and the mechanization of assembly operations.

A second important consideration in planning is the size limits which can be held in production machines. Experience has shown, for instance, that it is possible to manufacture screws with 360 threads per inch on a production basis. This could possibly be increased to 400 threads per inch. The diameter of these screws can be as small as 0.012 inch and it may be feasible to manufacture screws with diameters of only 0.010 inch. At the present time, these appear to be minimum size limits for screw production.

Gear teeth are being manufactured in production quantities to a diametral pitch of approximately 400, corresponding to a circular pitch of approximately 0.0080 inch. Teeth can be in various forms, such as involute, epicycloidal, conjugate and others and the gears include pinion-and-wheel combinations and racks. These gears are produced by milling with a single-tooth cutter or by hobbing. In some instances,



Fig. 1. Watch assembly is facilitated by use of precision fixtures. Because of small size of parts, all operations are performed under magnifying glass.

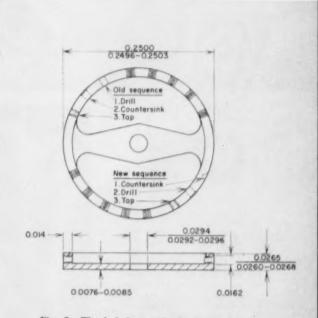


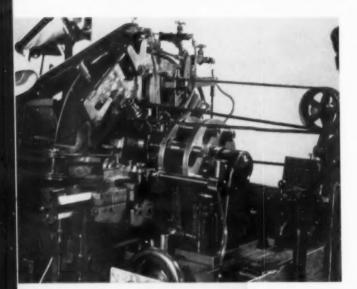
Fig. 2. Watch balance wheel, Original sequence of operations was to drill, tap, countersink. New sequence of operations—countersink, drill, tap—resulted in more efficient operation.

the teeth are highly polished.

Many miniature parts are produced on punch presses. In production, diameters of shaved holes can be held to within  $\pm$  0.0001 inch. With extreme care, this tolerance can be reduced to  $\pm$  0.00005 inch. Center distances on the die itself can be held to  $\pm$  0.0002 inch, with a resultant  $\pm$  0.0003 inch on the workpiece. Careful operation can reduce this to  $\pm$  0.0002 inch.

At Elgin, holes have been pierced through stock twice as thick as the punch diameter. In some cases this stock thickness has been exceeded; in most cases, however, stock thickness is held to one and one-half times the punch diameter.

Small machined parts such as staffs and pinions



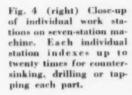
can be manufactured with diameters as small as 0.0030 inch on a routine basis. These parts are produced on screw machines, leaving 0.0002 to 0.0004 inch of extra stock for removal during polishing. In polishing, diameters are held to  $\pm$  0.0001 inch and surface finishes are in the range from two to four microinches, rms.

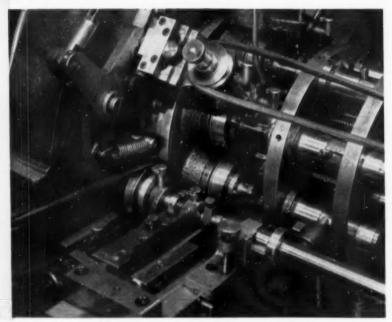
Drilling and Tapping Machine: Despite their small size, miniature parts are often handled automatically during machining operations. The small part illustrated, Fig. 2, is a typical example. This is a screw machine part which is processed through a die operation and then drilled and tapped. All drilled and tapped holes are located in the periphery of the part. The number of holes varies from two to twenty; in the part under discussion there are sixteen holes. Angular spacing of the holes is ± 15 minutes, and opposing holes must be perfectly in line with each other. There should not be more than 0.0002 inch horizontal variation of a line drawn through the centers of the holes. Holes are drilled with an 0.0100 drill and tapped with an 0.012-inch diameter tap, with 360 threads per inch.

Originally, three individual machines were used: one for the drilling operation, one for countersinking and one for tapping. The sequence of operations was:

- 1. Load for drilling
- 2. Unload
- 3. Tumble
- 4. Load for countersinking

Fig. 3. (above) Sevenstation indexing machine for fully automatic machining of balance wheels.





- 5. Unload
- 6. Load for tapping
- 7. Unload
- 8. Inspect

In addition to manual loading and unloading for each operation, a burring washer was manually inserted to prevent raising a burr during drilling.

One of the major problems associated with the three-machine method was difficulty in maintaining alignment when the part was moved from the drilling to the tapping operation. Unless hole alignment was perfect, tap breakage resulted.

To overcome these difficulties, a machine for performing all drilling, tapping and countersinking operations with the part in one position was designed, but was not entirely satisfactory. Accordingly, it was decided to develop a seven-station indexing machine, with automatic loading and automatic parts handling between each station. Design and construction of the new machine took eighteen months, plus six months for debugging.

The stations of the completed machine, Fig. 3, are:

- 1. Load
- 2. Countersink
- 3. Drill
- 4. Inspection of countersink and drilled hole
- 5. Tap
- 6. Inspection of tapped hole
- 7. Unload

All stations, Fig. 3, are indexed by a master turret, and parts are indexed up to twenty times at each

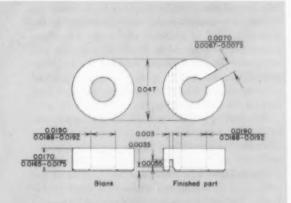


Fig. 5. Automatic machine loading expedited production of hard-to-handle small part. Chamfer was used for orientation.



Fig. 6. Close-up of tooling for cutting slot and groove in miniature part.

station, depending on the number of holes. Because all handling in the machine is automatic, the eight manual-handling operations required for the three-machine method have now been reduced to three: insert a loading tube, tumble parts after machining, and inspect after tumbling. The loading device is air-operated and a combination of air, hydraulic and electrical units performs the indexing operations.

Cycle time of the machine is from 15 to 26 seconds, depending on the number of holes in the work-piece. The countersink tool which performs the first machining operation is fairly substantial. The countersink is used as a spot for the drilling operation. After the drilling operation, a feeler gage checks to see that all holes are drilled and countersunk. If not, the machine is stopped automatically. The tapping mechanism is a positive gear-driven type with a ten-to-one lead screw-to-tap ratio.

One setup man can run and maintain four of these machines, as compared to one setup man and four or five operators required for the former method of operation. Tool life has been doubled with particularly significant improvement on tap life.

The new machine brought a new problem: a heavy burr was raised during drilling. This was not a problem with the three-machine method of operation, because a burring washer kept the burr from forming and, in any event, the part was tumbled prior to the next operation.

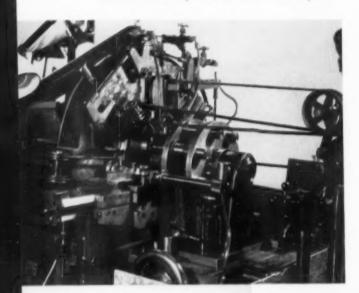
Many types of drills and numerous rake-angle variations were tried to eliminate the burr. While some drill designs apparently raised smaller burrs than others, no drill gave satisfactory results. When it was apparent that burrs could not be completely eliminated, the product design specification of "absolutely no burr" was re-evaluated by trying out

the teeth are highly polished.

Many miniature parts are produced on punch presses. In production, diameters of shaved holes can be held to within  $\pm$  0.0001 inch. With extreme care, this tolerance can be reduced to  $\pm$  0.00005 inch. Center distances on the die itself can be held to  $\pm$  0.0002 inch, with a resultant  $\pm$  0.0003 inch on the workpiece. Careful operation can reduce this to  $\pm$  0.0002 inch.

At Elgin, holes have been pierced through stock twice as thick as the punch diameter. In some cases this stock thickness has been exceeded; in most cases, however, stock thickness is held to one and one-half times the punch diameter.

Small machined parts such as staffs and pinions



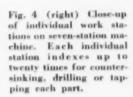
can be manufactured with diameters as small as 0.0030 inch on a routine basis. These parts are produced on screw machines, leaving 0.0002 to 0.0004 inch of extra stock for removal during polishing. In polishing, diameters are held to  $\pm$  0.0001 inch and surface finishes are in the range from two to four microinches, rms.

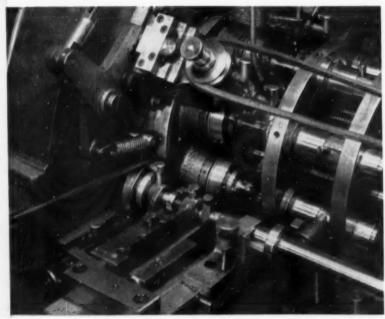
Drilling and Tapping Machine: Despite their small size, miniature parts are often handled automatically during machining operations. The small part illustrated, Fig. 2, is a typical example. This is a screw machine part which is processed through a die operation and then drilled and tapped. All drilled and tapped holes are located in the periphery of the part. The number of holes varies from two to twenty; in the part under discussion there are sixteen holes. Angular spacing of the holes is ± 15 minutes, and opposing holes must be perfectly in line with each other. There should not be more than 0.0002 inch horizontal variation of a line drawn through the centers of the holes. Holes are drilled with an 0.0100 drill and tapped with an 0.012-inch diameter tap, with 360 threads per inch.

Originally, three individual machines were used: one for the drilling operation, one for countersinking and one for tapping. The sequence of operations was:

- 1. Load for drilling
- 2. Unload
- 3. Tumble
- 4. Load for countersinking

Fig. 3. (above) Sevenstation indexing machine for fully automatic machining of balance wheels.





- 5 Unload
- 6. Load for tapping
- 7. Unload
- 8. Inspect

In addition to manual loading and unloading for each operation, a burring washer was manually inserted to prevent raising a burr during drilling.

One of the major problems associated with the three-machine method was difficulty in maintaining alignment when the part was moved from the drilling to the tapping operation. Unless hole alignment was perfect, tap breakage resulted.

To overcome these difficulties, a machine for performing all drilling, tapping and countersinking operations with the part in one position was designed, but was not entirely satisfactory. Accordingly, it was decided to develop a seven-station indexing machine, with automatic loading and automatic parts handling between each station. Design and construction of the new machine took eighteen months, plus six months for debugging.

The stations of the completed machine, Fig. 3, are:

- 1. Load
- 2. Countersink
- 3. Drill
- 4. Inspection of countersink and drilled hole
- 5. Tap
- 6. Inspection of tapped hole
- 7. Unload

All stations, Fig. 3, are indexed by a master turret, and parts are indexed up to twenty times at each

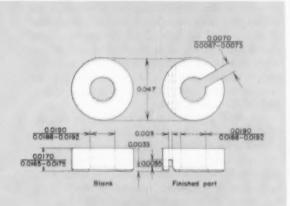


Fig. 5. Automatic machine loading expedited production of hard-to-handle small part. Chamfer was used for orientation.



Fig. 6. Close-up of tooling for cutting slot and groove in miniature part.

station, depending on the number of holes. Because all handling in the machine is automatic, the eight manual-handling operations required for the three-machine method have now been reduced to three: insert a loading tube, tumble parts after machining, and inspect after tumbling. The loading device is air-operated and a combination of air, hydraulic and electrical units performs the indexing operations.

Cycle time of the machine is from 15 to 26 seconds, depending on the number of holes in the work-piece. The countersink tool which performs the first machining operation is fairly substantial. The countersink is used as a spot for the drilling operation. After the drilling operation, a feeler gage checks to see that all holes are drilled and countersunk. If not, the machine is stopped automatically. The tapping mechanism is a positive gear-driven type with a ten-to-one lead screw-to-tap ratio.

One setup man can run and maintain four of these machines, as compared to one setup man and four or five operators required for the former method of operation. Tool life has been doubled with particularly significant improvement on tap life.

The new machine brought a new problem: a heavy burr was raised during drilling. This was not a problem with the three-machine method of operation, because a burring washer kept the burr from forming and, in any event, the part was tumbled prior to the next operation.

Many types of drills and numerous rake-angle variations were tried to eliminate the burr. While some drill designs apparently raised smaller burrs than others, no drill gave satisfactory results. When it was apparent that burrs could not be completely eliminated, the product design specification of "absolutely no burr" was re-evaluated by trying out

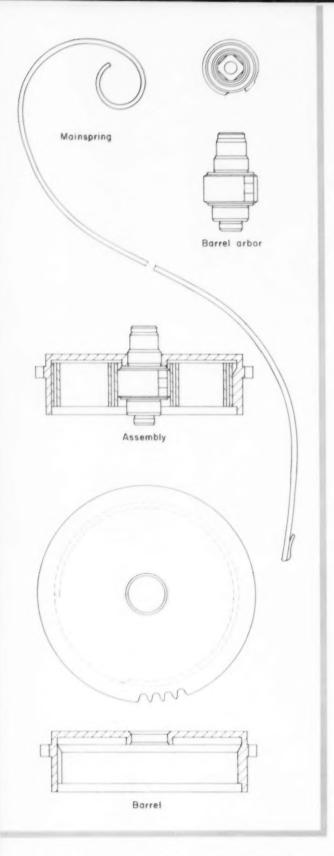


Fig. 7. Barrel, barrel arbor and mainspring were difficult to assemble manually.

parts with burrs in an assembled product. In making parts for these trials, the drill which seemed to throw the most solid burr without leaving stringy or ragged edges was used, and the parts were tumbled before assembly. The tumbling operation did not remove the burr but it did even off the protrusion sufficiently so that when the part was tried in the assembled unit it functioned satisfactorily.

Actually, the burr proved to be advantageous from a functional standpoint. Previously, there were only two and one-half threads holding the screw which is assembled to this part. With the protrusion, an additional thread was gained, eliminating a source of trouble. Thus, in this instance cooperation between product designers and tool engineers solved several problems.

Automatic Loading Methods: Often, it is possible to substantially improve the efficiency of existing machines by developing automatic loading and unloading methods. This was the case with the part illustrated in Fig. 5. A slot and groove are cut in the part on a special machine. Before the development of automatic parts handling, a total of four hand-loaded machines were required for production, with two machines for right-hand parts and two machines for left-hand parts. A fifth machine was used for small-lot production. Parts were oriented in relationship to a countersink on the hole diameter. One operator was required for each machine, plus the part-time services of a setup man.

In the automatically loaded machines, Fig. 6, parts from a vibratory feeder are stacked in a loading tube. Orienting parts before they entered the tube was a considerable problem, since the parts are symmetrical except for chamfered areas on one side. Two orientation methods were ultimately developed. The first method utilized an inside chamfer on the hole for orientation. The tube was loaded from the bottom by means of a pusher rod which reciprocated through a bowl of parts. A pin on the top of the pusher rod was shaped to the chamfer so that correctly oriented parts slipped onto the pin and were pushed into the loading tube. Incorrectly oriented parts were pushed off into the bowl. A finger held parts in the loading tube.

This method of feeding the loading tube was unsatisfactory because only one part was loaded for every five reciprocations of the pusher tube. Accordingly, another loading method was devised.

The 0.003-inch outside chamfer is utilized for orientation in the second method. A small vibratory hopper feeder accommodates parts to be loaded. Parts are fed up an inclined track. Both the bottom and side of the track are scraped smooth to prevent parts from sticking.

A step in the track, 0.002 inch high, orients the parts. As parts travel up the track, parts with the chamfered side down climb the step and continue up the track, while parts with the chamfered side

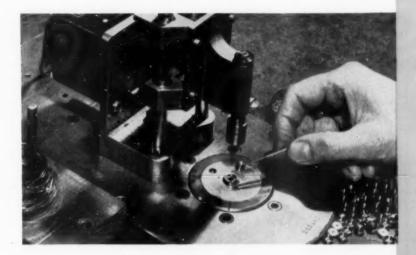


Fig. 8. (left) Barrel is positioned in assembly fixture after spring has been wound around arbor.

Fig. 9. (below) Feed mechanism for delivering arbors to machining operation. Correctly oriented parts pass through slots in drum to magazine. Feed fingers remove parts from magazine, place them between centers of machine.

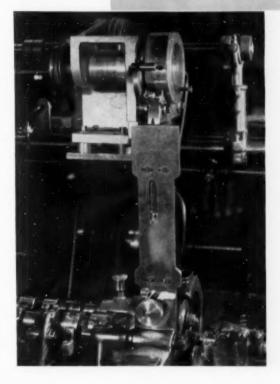
up drop off the track into the hopper.

When parts arrive at the top of the track, they drop down a curved chute to the loading tube. A push rod forces them through the tube to a spring type guide, which pushes them into position over the work-holding spindle. The spindle then comes into position, removing the work from the guide, the guide retracts, and the operation of the machine starts. After completion of the work cycle, parts are withdrawn through a suction tube and desposited in a container.

This feeding method has been fully satisfactory. Two machines now produce as many parts as was previously possible with four machines.

Mechanized Assembly: Fully automatic assembly of miniature components is still some distance in the future, but there are numerous examples of mechanized assembly which have resulted in improved efficiency and, often, improved product quality. A particularly troublesome problem, for instance, was assembly of three miniature components—a spring, arbor, and a barrel, Fig. 7.

In the former method of assembly, an operator, using a miniature lathe, hooked the spring end over a special forming arbor, wound the spring to a predetermined diameter, placed the barrel over the spring and then ejected the spring from the forming arbor into the barrel. The next operation was to put the barrel arbor into position. Picking up the arbor in specially formed pliers, the operator hooked the spring to the arbor and inserted the bearing end of the arbor into the barrel. Considerable skill was required for this operation. If the arbor was cocked at a slight angle during insertion, the bearing surface of the barrel would be scratched or roughened or a minute amount of metal would be shaved off. In either case, the bearing surface was



marred. Further, any chips shaved off during assembly might possibly get into the mechanism, causing malfunctions in service.

This condition has been eliminated with the development of an improved semiautomatic assembly method. In the new method, the barrel arbor is held upright in an assembly fixture, Fig. 8, and is rigidly supported from both sides. The spring is hooked onto the upright arbor and positioned between roller guides. A solid guide section around the spring holds it in contact with the arbor at all times. An anvil holds the arbor in position.

When the spring has been wound around the ar-

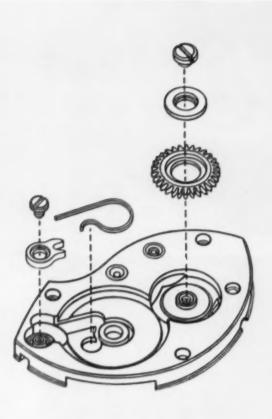


Fig. 10. Initial operation in assembly of watch movements. Assembly shown is a top plate.

bor, the anvil is withdrawn, the barrel is positioned over the top of the spring and arbor, and the spring and arbor are released into the barrel. The new procedure has eliminated damage to the bearing surfaces of the barrel and reduced the torque requirements of the spring. At the same time, it has increased production over 35 percent, making it possible for three new machines to perform as much work as five of the previous machines, and inspection is simplified.

Looking into the future, it may be possible to devise a fully automatic assembly machine to perform all operations. The barrel itself can be easily handled, but any handling method developed must not damage the teeth. Automatic handling of the spring is more difficult and, at the moment, no satisfactory method has been developed.

Automatic orienting and loading methods for the arbor have already been worked out for a machining operation, and the same methods could be used for assembly.

In the feed mechanism for machining, Fig. 9, arbors are held in a revolving hopper, which has



Fig. 11. Assembly fixture. Screwdriver is mounted on swinging arm. Screw is picked up from magazine by vacuum, then screwdriver is swung to position over assembly fixture.

some twenty openings the same shape as the arbor. The arbors are not perfectly symmetrical, so as the hopper revolves, only parts which are correctly oriented pass through the shaped openings. Other parts fall back into the hopper. Correctly oriented parts pass into a chute leading to a loading tube. With each revolution, from one to three openings deliver a part to the loading tube.

Feed fingers pick arbors from the tube and place them between centers in the machine, which mills a square on the arbor. Parts are ejected by compressed air.

Assembly of watch movements, has been mechanized to a considerable extent. An automatic screwdriver is used to assemble the components shown in Fig. 10. Screws are loaded into a circular magazine by suction. There are approximately 150 holes in the magazine, in two rows. The magazine and screws are put in a suction type holder and the holder is shaken several times, pulling screws into place. Excess screws are returned to a container.

The screwdriver is designed with a shell which fits the outside diameter of the screw head and holds it in position by suction. A screwdriver blade fits inside the shell. The screwdriver is mounted on an arm so that it can be swung into position to pick up a screw, then located against a positive stop in the correct position for assembly.

To assemble the unit, an operator places the watch plate on locating pins in a work pad, Fig. 11, puts the various other components in position, picks up a screw from the magazine with the automatic screwdriver and inserts the screw. Similar equipment and procedures are used for the next assembly operation, Fig. 12, in which the previously-assembled top plate is fitted onto a larger bottom plate.

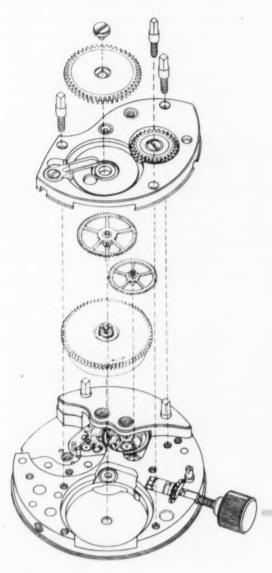
The operator places the large plate in position on the work-holder pad and then puts the wheel and pinion assemblies into their respective bearings in the proper sequence. These assemblies must be absolutely vertical or there will be difficulty in putting the top plate in position from a positive location. Diameter of the pivot is 0.0031 inch; diameter of the bearing hole into which the pivot is inserted is 0.0035 inch.

Several methods for holding the pivot upright were tried out. Applying suction to the bottom plate was of some help, but was not foolproof. The problem was solved with the development of fingers which are moved under the pivot wheel after all components are assembled. These fingers hold the pivot upright, but do not pull the pivot out of the bearing in the bottom plate.

With the fingers in place, the operator picks up the top plate with a suction device. The bottom plate is moved into position under the top plate. The top plate is then lowered into position. Steady pins and pivot bearings of the two assemblies are in positive alignment so that the top plate fits perfectly into place. This method of assembly is much faster than hand alignment and bending of the pivots resulting from improper alignment is eliminated.

After the suction spindle holding the plate is withdrawn, the whole assembly is repositioned under the screwdriver spindle and the screws are put in place, Fig. 13.

It is evident from the examples illustrated that the manufacture and assembly of miniature components presents no insuperable problems. With sufficiently large product volume requirements, it is feasible to develop mechanized handling methods. Such methods result in improved efficiency, lowered rejection rates and higher quality.



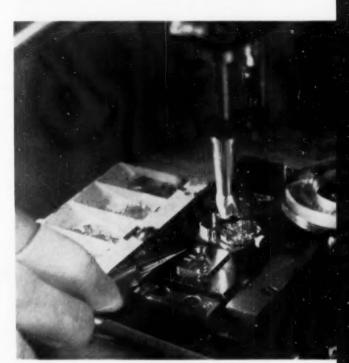
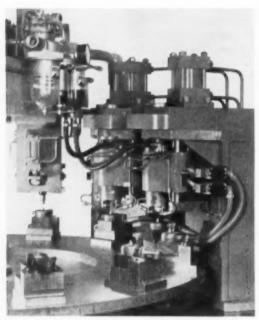


Fig. 13. Partially assembled watch movement, ready for assembly of screws.

Fig. 12. Assembly of watch top plate to bottom plate.

# designed for PRODUCTION

### Spinning Operations Done by Assembly Machine



SPINNING stations are included in the sequence of this automatic assembly machine. The first spinning station is used to rough spin the socket over the closing disk. The second station finish-spins the socket. A mist spray is used to lubricate the rolls at both of these stations.

BALL-JOINT unit is automatically assembled from eight components. Either right or left-hand joints can be assembled after minor adjustments are made on the holding fixtures. Parts of the unit are, from the left: steel forging, steel insert, powder-metal bearing, stud, bearing, insert, closing disk and grease fitting.

D esigned for assembly of the upper ball-joint unit of an automotive steering mechanism, this machine has an operating cycle of six seconds and includes two spinning operations. The 12-station machine can be operated by two unskilled workers. The machine can be converted from production of left-hand ball joints to right-hand units by interchanging one rest pad and one diamond locator in each of the 12 fixtures.

Although design of the part to be spun requires spinning rolls of smaller diameter than would be used conventionally, lack of vibration in the machine assures long roll life. In addition, spinning rolls are lowered hydraulically to give positive pressure with maximum control.

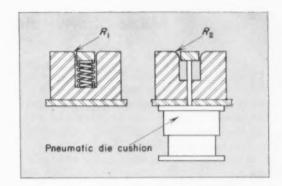
This machine, developed by Cimco Engineering Co., automatically assembles components, most of which are inserted manually. In addition to the assembly operations performed by the machine, it also automatically supplies grease during assembly and after the unit is complete.



### Die Cushions Improve Parts

Pneumatic die cushions can be used in forming dies to improve both the product and the process. When springs are used in forming dies, they sometimes limit the cavity lip radius,  $R_1$ , so that maximum depth will be available for the spring. Even with this added depth, springs frequently must be designed for short lives, which means frequent replacement. Also, although maximum pressure is needed to hold the part at the beginning of the draw operation, springs offer most resistance at the bottom of the stroke.

Through use of a pneumatic die cushion, developed by Dayton Rogers Mfg. Co., a much larger radius,  $R_2$  can be used and almost the full depth of the die is available to do the forming work. With a larger lip radius, less pressure is needed to form the workpiece and die marks and distortion are

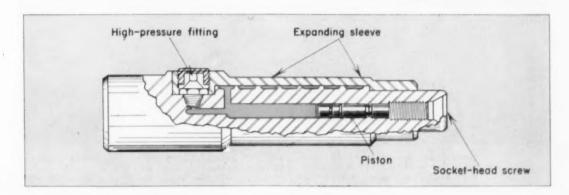


minimized. Because air pressure can be raised during the work cycle, maximum pad pressure is available when it is needed. Normally, however, pressure remains more-or-less constant during the entire cycle and finished-part ejection is smooth.

### Arbor Expands To Hold Tool or Workpiece

Operating principle of this expanding arbor is simple. Expansion is accomplished by hydraulic pressure, which gives accurate, equalized centering. In this simple model, the hydraulic piston is actuated by turning the screw. For high-volume production setups, the piston can be mechanically operated. When force is applied to the piston, hydraulic fluid is forced from the piston chamber through a port and into the space between the expanding sleeve and the arbor body.

Such Hydra-lock tools are used for precision boring, grinding and gear-cutting operations. The arbors, developed by A & C Engineering Co., expand about 0.003 inch per inch of arbor diameter. These arbors conform to the internal surface of the tool or workpiece so there is sufficient holding power even when bell-mouth or taper is present. A high-pressure grease-gun fitting is used to introduce the hydraulic fluid into the piston chember. Refilling is done with a hand-operated grease gun.



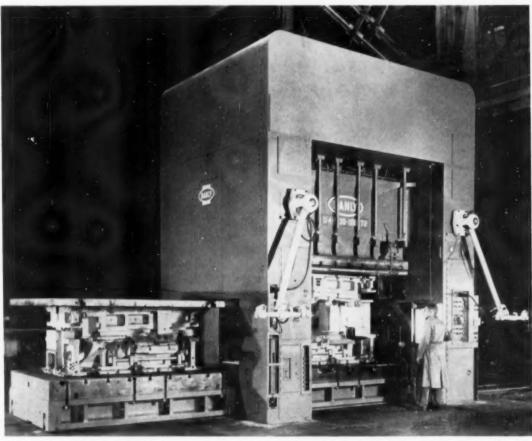
### DESIGNED FOR PRODUCTION

## Additional Bolsters Make Short Runs Practical

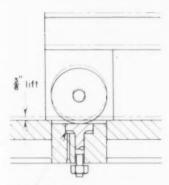
Higher press speeds achieved in recent years have created production-scheduling problems. If runs are the same length as before, increased storage facilities are needed. If more die changes are made, considerable production time is lost in order to maintain storage banks at normal levels.

With presses having two bolsters, such as this one developed by Danly Machine Specialties, Inc., production runs can be set at the optimum length and dies can be changed whenever necessary. Dies can usually be interchanged in no more than 30 minutes.

The bottom half of the die is located and held by the die carrier, which is bolted to the press bed. An adapter plate is fastened to the upper half of the die and it is clamped to the press slide. Clamps are air-operated and controlled from the master press panel, as are the die carriers.

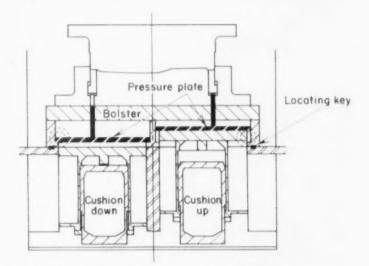


QUICK-CHANGE press has uprights designed with holes so dies and die carriers can pass into and out of the working area. Mechanical handling equipment for both dies and workpieces can be more permanent because it need not be moved for each die change, and presses can be set closer together. Die change-overs can be made on nonworking bolsters when cranes are available.



Lifter cylinder

DIE CARRIERS are individually driven by motors. When dies are not being assembled, carriers can be moved partially through upright openings to widen aisles. Carriers are moved into working position against positive stops. In the stopped position, the wheels are over hydraulic cylinders. These are lowered so the carrier drops accurately over keys and rests solidly on the press bed.



Cushion Retracted

Cushion in Position

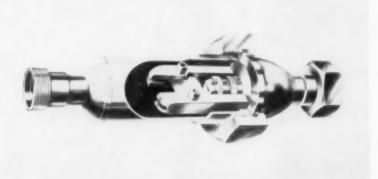
AIR CUSHIONS can be used because the carrier rings have a shoulder on the lower side for seating a pressure-pin plate so standard pressure pins can be installed in the die-loading position. Before die carriers are moved, cushions are dropped below the top of the press bed. Cushions have double air chambers and only the top one has to be exhausted to drop the cushion.

### Vibrating Blade Causes Liquids To Emulsify Themselves

Without an external ultrasonic generator or the loss of energy caused by transfer from one medium to another, this ultrasonic emulsifier induces fluid-dynamic forces (sound waves) within liquids. All energy is developed and used within the liquid. This ultrasonic energy successfully emulsifies liquids with either high or low viscosity. The Rapisonic, produced by Sonic Engineering Corp.,

has a capacity of 5 gpm without need for premixing.

Because it operates as a closed system, air cannot be introduced during operation. The only component that has a high wear rate is the vibrating stainlesssteel blade. Even under arduous conditions, blades last at least three months, and they are inexpensive and easy to replace. A standard electric motor and a gear pump are used on this equipment.

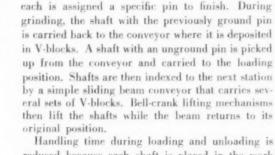


ULTRASONIC HEAD sprays a jet stream of liquid onto the edge of a blade. The blade vibrates at its natural frequency (about 22,000 cps). Cavitation occurs continuously in the volume swept by the vibrating blade. High local pressures are created, which result in emulsification without premixing. Fluid flow is from right to left.

### DESIGNED FOR PRODUCTION

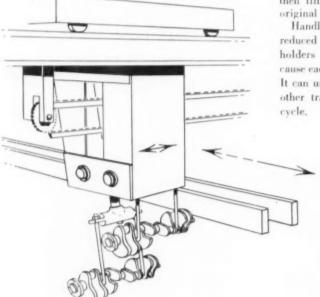
### Crankpin Grinder Saves Transfer Time

Because grinding time on automotive crankpins is constant, time savings can be achieved only by reducing nonproductive time. The first step was design of an automatic transfer grinder with four heads (THE TOOL ENGINEER, April 1955, pp. 94-95). Redesign of this machine by the Norton Co. has resulted in further time savings.

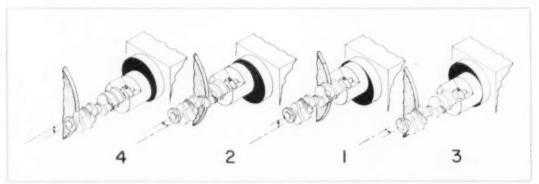


All grinding heads grind at the same time and

Handling time during loading and unloading is reduced because each shaft is placed in the work holders with the correct angular position, and because each transfer mechanism has two sets of hooks. It can unload and load with little lost time, and all other transfer motions occur during the grinding

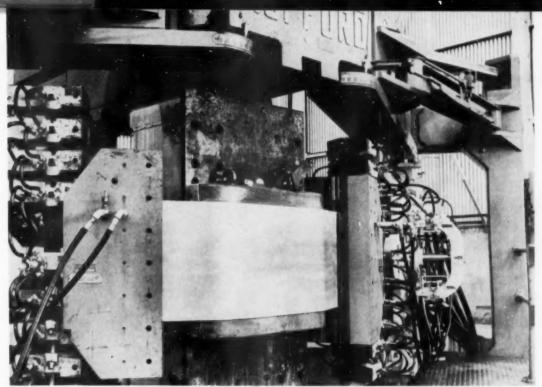


DOUBLE HOOKS on individual transfer mechanisms at each grinding station speed unloading and loading. As the ground shaft is removed by one set of hooks, an unground shaft is placed into the work holders by the other set of hooks. The work-loading mechanism carries the ground shaft to the conveyor, deposits it and picks up an unground shaft. Crankshafts are moved from station to station in V-blocks carried by a sliding beam.



WORK LOCATION at the four grinding stations is simplified because angular orientation is set at beginning of machine and is maintained through the several stations. Shafts assume the correct angular location when they are deposited in the work holders and no time is wasted by shaft roll-over. At each grinding station, work holder places shaft with the

crankpin to be ground on the center of work-head rotation. Work holders and their relation to the center of rotation, are shown for the four stations. Numbers identify the pin ground in the station. Work is stopped in the exact angular position for unloading and unloading. The machine is designed to finish grind 240 pins per hour.



Plastic stretch die used in a Hufford press at North American Aviation, Inc.

# QUALITY CONTROL for plastic tools

By John Delmonte

General Manager Furane Plastics, Inc. Los Angeles, Calif.

W ITH THE WIDESPREAD ACCEPTANCE of plastic tools by industry, standards have become a necessity. Realizing this, the tooling division of the Society of Plastics Industry, Inc. is already in the process of drafting a set of standards. Also, under the auspices of the ASTE Research Committee, methods of measuring the characteristics of plastics are being worked out.

Since the physical behavior of plastics is influ-

enced by more variables than the behavior of metals, it is difficult for toolmakers to establish sound procedures for evaluating the quality of plastics. Many companies using large quantities of plastic tooling materials have, however, established standard test procedures.

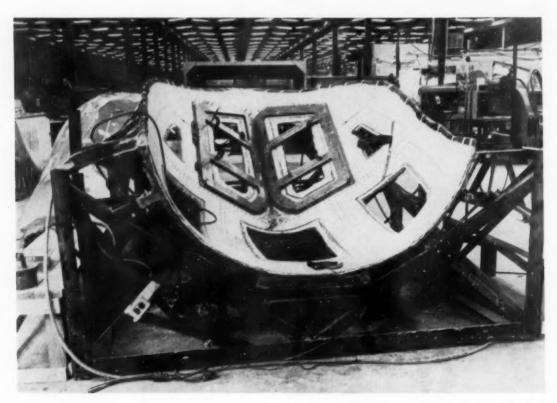
As new standards appear, many of the present quality control problems will disappear. Consequently, plastic tool builders will be able to concentrate on tool design rather than on the chemistry and compounding of plastics. These problems properly belong to the plastics formulator.

Before a plastic material is approved for tooling, there should be ample evidence, through careful tests and properly supervised field trials, that the material is suited for the intended application. Once a material is adopted, measures must be adopted to insure uniform behavior of the material in toolmaking and in service.

### **Quality Control Test Methods**

Some of the most significant physical characteristics of plastics from the standpoint of the tool builder are:

EXOTHERMIC TEMPERATURE RISE: The internal temperature rise of an epoxy after the addition of a curing agent suggests limitations on the thickness of reactive resins which may be cast. For many





(above) Plastic master gage made at Convair Fort Worth Division.

(left) A plastic spin chuck 5 feet in diameter for spinning 0.080 Inconel metal.

MIXING: Uniformity of properties depends on uniform resin and filler distribution. This distribution can be checked by testing the density of samples of the material.

Shrinkage: Many plastic tools are precision tools and accurate data on shrinkage is essential. Shrinkage tests on plastics require long periods of time. Accumulated service information is helpful in determining shrinkage values.

CREEP: Creep under continued stress is another important factor in plastic tools. Creep is influenced by curing agents and resin systems.

Adhesion: Epoxy plastics are used to "cap" metal castings and provide accurate working faces. Adhesion to the metal should be ascertained by conducting appropriate tensile shear test. This adhesion is also important when epoxy plastics are used to repair metal die facings.

These quality control checks are most effective when submitted by experienced formulators. A program of evaluating plastic tooling becomes quite

tools, one-half to three-quarter-inch maximum thickness is specified.

GEL TIME: The time of gelation of a mass of resin and curing agent depends upon prevailing ambient temperatures and the mass of material undergoing test. The material should be mixed at a frequency commensurate with time of gelation to minimize losses in setup material.

STRESS-STRAIN CURVES: Basic stress-strain data are the "fingerprints" of a plastic material. Correctly analyzed, the limitations of some plastics can be noted and compensated for in tool design.



Label cites results of tests performed upon batch of material. It indicates that the plastic has already been tested for performance.

costly to a tool manufacturer if he has to engage personnel and set up complete procedures for checking materials and their many variables.

### **Shop Practice for Quality Control**

Manufacturers of plastic tooling have found it to their advantage to procure quality controlled materials which have been thoroughly tested so that a reasonable warranty of performance may be assured. One method of certification is based on tests performed on every batch of material, indicating that the plastic has already been tested for performance.

However, quality control programs should extend to the shop. Tool foremen should maintain accurate records upon every laminated and cast plastic tool, noting the resin used and its batch number; the hardener used and its percentage; time and temperature of curing; and the special release system used.

Also, foremen should keep small cast samples of major tools with appropriate identification,

### Completed Plastic Tool

Inspection of the completed plastic tool poses a problem whether it is the cap on a rough metal casting or a precision-laminated checking fixture. Functionally, dimensional tolerances are of prime importance and, as some plastic tools have "soft" spots, it is highly desirable to eliminate these variations to hold over-all tolerances. This can be accomplished by thorough mixing. Uniform mixing of the plastic and the curing agent is so essential to good performance that a positive visual means of checking is highly desirable. This is possible through the use of colored hardeners. If the usual colorless hardeners are used, point-by-point examination over large tool areas is impractical.

Hardness gages may be misleading for checking the surface of plastic tools. Shore or Barcol hardness gages are frequently used and will reveal the hardness at a particular point. After establishing an average value, and after compensating for tem-



Aluminum filled plastic used to repair metalworking tool, in this case a drop hammer die.



Master checking gage for fuselage is aluminum casting faced with plastic. This gage has been in service since the fall of 1956.

perature, the data are significant only if there is adequate information on the hardness of the resin/hardener versus time or as a function of cure. The misleading results stem from the fact that high surface hardness readings may be looked upon as criteria for high strength. Quite the contrary, toughness, as measured by stress as well as deformation, is not indicated by high surface hardness and the toughest materials are not usually the hardest.

These are a few of the high points that must be considered when establishing a quality control program for plastics. As new plastics are developed, there will be an even greater need for standardization in this field. Quality controlled plastic tools are a credit to both the plastics industry and the tooling industry because the experiences of each field have been coordinated for effective results.

### mechanically tabulating and analyzing

## Die Performance Records

By N. G. McRae

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and

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Recording data concerning die performances in order to study shortcomings and take corrective action has been widely recognized by management as an effective tool in controlling die maintenance costs. However, accumulating and analyzing such records manually can prove a tedious and time-consuming task, especially if the number of die runs involved is in the range of 500 to 2000 per month, as is the case in a number of divisions of the Westinghouse Electric Corp. This can adversely affect management's acceptance of such a program.

Using tabulating equipment to mechanically record die performance has eliminated the need for clerical help to manually record this information. This results in a more complete and continuous record. Also the program does not suffer from the continual changing of personnel.

Now these records are not only being tabulated mechanically, but are being analyzed mechanically as well, Fig. 1. By this means, management is getting reduced operating cost at reduced clerical cost. Although new developments in this program are primarily involved with the tabulating and analyzing of data, the complete program will be outlined for the sake of clarity.

### Originating Information

Information such as tool number, engineering drawing number and item, is entered by the die setter on the tool record tag, Fig. 2, as part of the die setup. Information concerning number of pieces produced, code number denoting reason for stoppage and similar data, is added to the record tag at conclusion of run by the die setter. When the die is removed from the press, the record tag is delivered to the desk of the foreman of the press department. If the die requires no repairs, the foreman initials the tag and sends it to the tabulating department. If repairs are required, the foreman initiates a requisition authorizing the repair section to service the die. The requisition and record tage are delivered to the die analyst and the die is delivered to the repair section.

When the die is opened in the repair section, the analyst is consulted by the group leader of the repair section concerning the extent and nature of the repairs required. At this time the analyst verifies the code number as entered by the die setter on the record tag. Upon completion of the required repairs, notations as to the time spent, amount ground from punch and die, identity of section making repairs and related information, are entered on the record tag. The record tag is then delivered to the foreman of the repair section, who initials and forwards it to the tabulating department.

The need for and the benefits derived from such a program have been thoroughly covered in an article by E. E. Griffiths of Westinghouse, which appeared in the April 1953 TOOL ENGINEER.



Fig. 1. (above) Part of Westinghouse facilities for processing die performance data.

Fig. 2. (right) Die record tag completely filled out.

### Mechanical Tabulation

A tabulating card is keypunched for each use of a die as reported on the tool record tag. The tabulating detail card, Fig. 3, shows the information that is extracted from the record tag. The sequence of information, the size of the fields, and the field spacing on the tabulating card are determined by local machine requirements and are not of vital importance.

The detail cards are accumulated for a period of one month. At the cutoff date, the cards are merged with active detail cards from preceding months, sorted into date sequence (with newest date or latest use record first) and then into tool number sequence. By this procedure, the cards are arranged by tool number with all cards having the same tool number in date sequence. The reason for sorting by date, with newest date first, is that only the last six use records of a tool are considered in the analysis and report. The punching die of the computer is set up to punch a control hole in detail cards indicating seven runs or more and the card is excluded from calculations. These cards are segregated, filed in an inactive file, held for one year and then discarded. This keeps the analysis current and makes it possible for any corrective action taken to immediately affect the analysis.



The complete detail file is merged with summary cards, Fig. 4, that are punched with only the tool number and a control hole for identification—to enable the machine to differentiate between summary and detail cards. These summary cards are filed behind each set of detail cards, one summary for each set.

#### Mechanical Analysis

The first approach to analyzing die performances mechanically was to establish arbitrary standards for the minimum number of pieces produced per hour of repair and the minimum number of pieces produced per 0.001 inch of die life and punch life. These standards vary according to the type of die. To expedite matters, ten types of dies requiring ten sets of standards were chosen. To use these standards effectively it was necessary to summarize from the detail cards and record on the summary cards the following information for the last six runs:

- 1. Total pieces produced
- 2. Total repair hours
- 3. Pieces per hour of repair
- 4. Pieces per 0.001 of die
- 5. Pieces per 0.001 of punch.

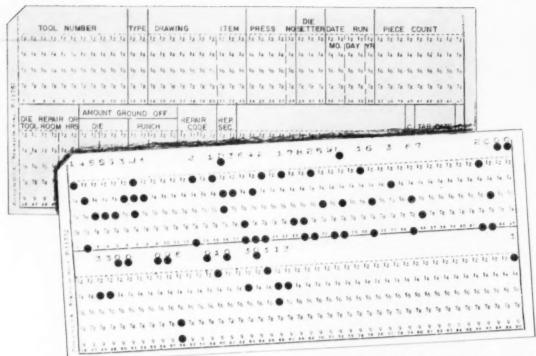


Fig. 3. Punched detail card with headings.

Summary cards were then run through the computer and each of the above items was compared to the established standard. Any die failing to meet any one of the standards was segregated and listed with all pertinent data on a report, Fig. 5, which was issued monthly.

As these reports were issued and put to use, it became evident that two of the three standards (pieces produced per 0.001 inch of die life and pieces produced per 0.001 inch of punch life) were relatively unimportant because of the low initial cost of the majority of the dies. This necessitated a change in the approach to the analysis: the estabment of standards based primarily on the number of pieces produced per hour of repair. It is important to note that where the majority of dies involved in such a program are of relatively high cost, the use of all three standards might well prove advantageous.

Consideration was first given to evaluation of results strictly on a pieces-per-repair-hour basis. This proved unsatisfactory because dies producing fewer pieces and requiring fewer repair hours were taking precedence over dies producing many pieces and requiring many repair hours. Accordingly, the number of repair hours was squared in order to weight this factor. Although this brought considerable improvement, it was yet not completely satisfactory.

However, when the number of repair hours was cubed and divided by the number of pieces, an index figure was obtained. This had the effect of reducing in importance certain poor performance tools which had low production but required little repair time.

As a result of this development it was necessary to revise the tabulating procedure slightly. Rather than report the information mentioned above on the summary card, it was now necessary to record the total number of pieces produced, total repair hours, total number of runs and the index figure as computed by the machine. These summary cards are sorted by the index figure in descending order. The ten summary cards which have the highest index are selected. The related detail cards are segregated from the active detail file. A report issued monthly, Fig. 6, shows first the details, followed by the summary of each of the ten poor performing dies. After the report has been completed, the summary cards are destroyed and the detail cards returned to the active file.

### Corrective Action

To realize the maximum benefit, it is necessary that the report reach the hands of personnel qualified to initiate appropriate action as dictated by the information in the report. For this reason, a copy of the list of poor-performance dies is furnished to the die analyst, preferably a week to ten days prior to the meeting of a tool efficiency committee. This is a committee composed of the pressroom supervisor, toolroom supervisor, die analyst,

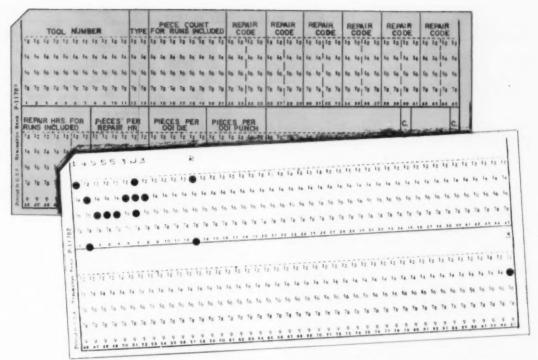


Fig. 5. Summary card with only tool number and control hole.

manufacturing engineer and headquarters representative. The chairman of this committee is the pressroom supervisor who is of course, most concerned with controlling the expenditure for maintaining his tools.

The membership of this committee is flexible to permit representatives from interested departments to attend meetings when the situation demands it. In preparation for the tool efficiency committee meeting, the die analyst secures engineering drawings of the part, tool sketches of the die, and any other pertinent information regarding the history of the die. At the meeting, the ten poor performance dies are discussed individually and corrective action is decided upon. In some cases, this can involve major changes to the die or a redesign of the die or the product. The extent of corrective action is determined by the economics of each case. It is the responsibility of the die analyst to initiate the corrective action decided upon by the committee.

Upon completion of corrective action, the tabulating department is notified by the die analyst and the activity records of that tool are removed from the active file and placed in the inactive file. Subsequent runs—to a maximum of three—using that tool are reported to the tool efficiency committee for review. After three runs satisfactory to the tool efficiency committee have been completed, the detail records are placed in the active file and again become a part of the normal operation. In this way

Fig. 5. Monthly report based on established standards.

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Fig. 6. Monthly report based on index figure.

the committee is mechanically furnished with upto-date information concerning the performance of dies upon which corrective action has been taken.

### Gaging Program Effectiveness

A summary report, Fig. 7, is issued, quarterly and serves as a barometer indicating the effectiveness of the over-all program. This report tells how the dies are performing by type, and indicates which failures occur most frequently. Additional items of information which are contained in this report, enable the establishing of quotas for any of the following:

- 1. Pieces per run
- 2. Repair hours per run
- 3. Pieces per repair hour
- 4. Amount ground off punch and die per run
- 5. Pieces per thousandth of punch and die life.

# Summary

The development of this mechanical method of tabulating and analyzing die performances has resulted in additional expense savings over and above those resulting from the initiation of the original program some three or four years ago.

Over that period of time, the Newark Meter Div. of Westinghouse has succeeded in reducing die maintenance cost per net allowed hour from \$1.67 to \$1.32. However, the services of a clerk were required full time, and much of the time of the die analyst was required for manual review and analysis of bulky records.

The mechanical approach has resulted in the complete elimination of the need for clerical help, and has freed the die analyst for more productive efforts.

				JAMU	ARY 15 THRU	APRIL 15, 195	7			
Type	Die Repair Cole	Total Runs	Total Piece Count	Total Pieces Per Run	Total Repair Hours	Total Pieces Per Repair Hour	Total Ground Off Die	Total Ground Off Punch	Total Per .001" (Die)	Total Per .001" (Punch
I. I.	101	1 11 96	55000 556700 372531	55000 50609 3880	15725	35140	117	122	4758	4563
					a items om	nitted to cons	erve space	)		
1 1 1	1.06 1400 1700	1 2	2000 h0000 h00	2000 2000 800	1200 1200	444 3333 33	10 13 5	10 15 5	3076 80	200 2666 80
Summer	y For Typ	e 1								
1		191	1500953	7858	83975	1787	1002	973	1497	1542
2 2	301 301 105	11k 31 4	704250 269890 12950	90.303 8706 3237	34650 1500 2700	2032 17992 479	109 8	197 10	6461 33736	3574 26989
				(	30 items of	mmitted to con	merve space	e)		
2 2 2	1500 1501 1700	1 10	3600 1600 24 520	3800 1600 2h 32	2000 4100 55850	190 39 43	5 10 81	7 12 86	760 160 300	542 133 282
Same	y For Typ	e 2								
2		135	1746201	12934	288550	605	659	861	2649	2028

Fig. 7. Summary report.

# Research Dynamometer

# records torque at every angular position

By Stefan Gorecki

Posen, Poland

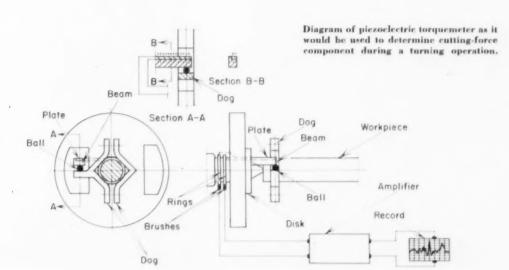
Because present day dynamometers do not meet all the needs of metalworking researchers, other techniques and equipment are being developed. One such machine is based on the piezoelectric phenomenon that occurs when a ferroelectrical plate is subjected to bending. With this meter, continuous torque measurements can be taken on all types of rotating machinery. Other types of meters give a recording for only one angular position of the measured shaft. With these meters, the measured magnitude of the torque does not necessarily correspond to its absolute value.

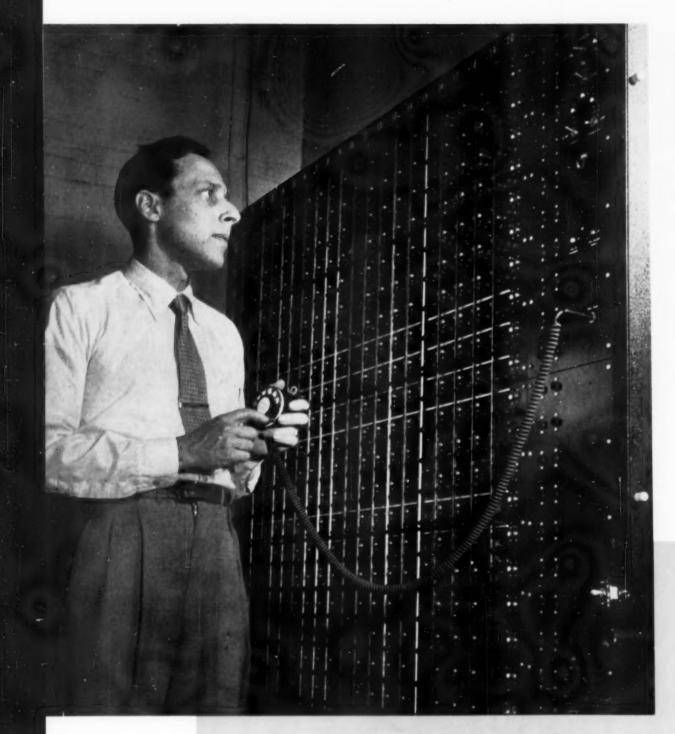
Heart of the new meter is a ferroelectric plate that is mounted in such a way that its mechanical deflection is proportional to the torque being measured. This plate can be made of BaTiO<sub>3</sub>, NaKC<sub>4</sub>H<sub>4</sub>O<sub>6</sub>\*4H<sub>2</sub>O or KH<sub>2</sub>PO<sub>4</sub>. Bending causes a difference in the potential on the surface of the plate. These changes in potential cause small changes in voltage, which can be amplified and recorded. Through use of a calibration curve, the recorded curve can be evaluated to indicate torque

magnitude at any angular position of the shaft.

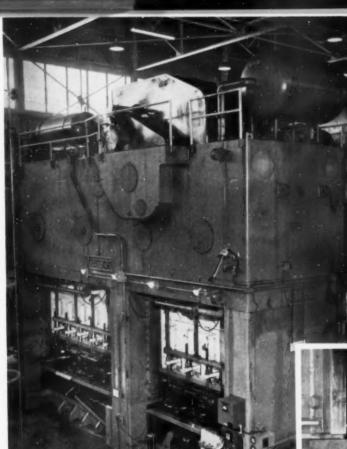
In the diagram, the torquemeter is mounted on a metalworking lathe to measure the torque and changes in the cutting-force component. A steel cantilever beam of rectangular cross section is securely fastened in a disk mounted on a faceplate. The free end of this beam is acted upon by the force exerted on the dog and transmitted through a ball. A recess in the beam holds the ferroelectric plate. Any deflection of the beam causes a corresponding deflection in the plate. These deflections are proportional to the transmitted torque.

These deflections appear as vibrations at the free ends of the beam and plate. The vibrations cause different potentials on the sides of the plate perpendicular to the direction of force and generate alternating voltages. The plate is connected by conductors to the slip rings. Voltages generated at the plate appear at the rings. After amplification, these voltages are recorded and give an accurate, permanent record of torque variations. This record can be analyzed at any time.

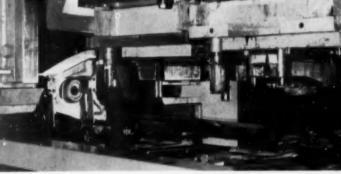




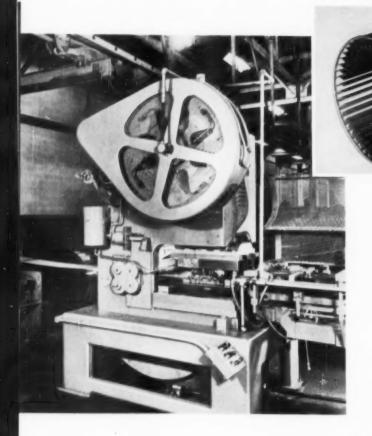
ELECTRICAL BLACKBOARD, developed by Operations Research group at University of Michigan, gives short-cut solution to a problem in machine job assignment. A systems engineer of the school's Engineering Research Institute tries out various schedules by dialing jobs and machine costs into the rows of indicators. Jobs are shuffled mechanically to get the optimum program.



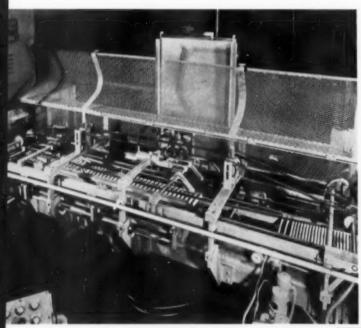
PRESS AUTOMATION is characterized by ingenious dies at Ford Sterling chassis parts plant. The 10-station press produces front suspension arms. (close-up) Turnover wheel between segments of press flips parts over after they have moved through the first four dies. View is from rear of press and part in vertical position is being transferred to fifth die.

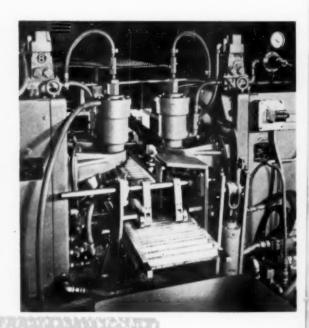


# TOOLS at work

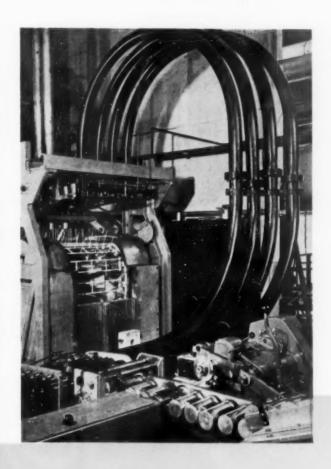


INTEGRATED STAMPING, assembling and welding operations on a subassembly line produce 150 blower wheel cages per hour at Mayne Products Co., Dayton. Ohio. In the first step. (top) strip steel enters a 75-ton Precision Flexopress through an integral feed mechanism. Blower louvers are pierced, lanced and formed at 120 strokes per minute. Completed stampings are transferred by special tooling, (lower left) which accurately interlaces two segments, positions and indexes them for the welding station. Two specially tooled 30 KVA bench welders (lower right) automatically index and join the two stampings with 38 high-strength welds. Adjustable limit switches automatically start an electronic timer which sequences the weld and index steps.

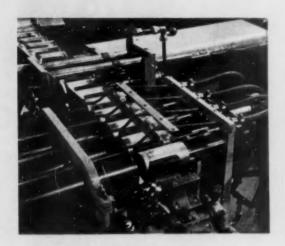


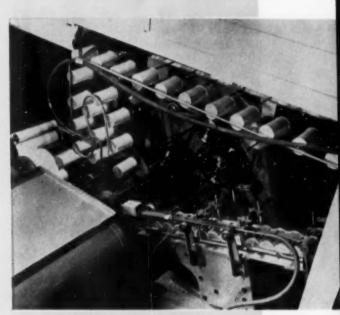


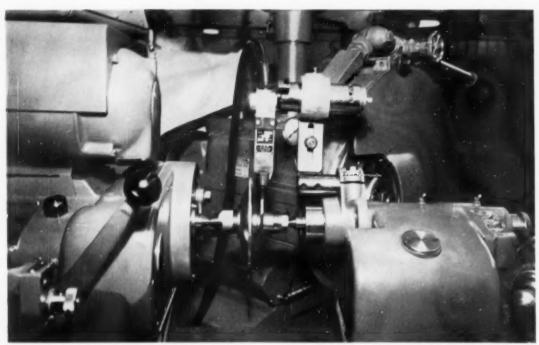
TOOLS at work



ALUMINUM CAN MAKING LINE is automated by ingenious transfer and feed methods. Seamless can production at Aluminiumwerke, Goettingen, Germany a subsidiary of Aluminium Limited, begins with impact-extrusion of the can body. From the press, can bodies are fed down a hopper to a suction transfer tube (top). Tooling details of the automatic system for inserting cans into the pneumatic conveyor tubes are apparent from the close-up (center). At this point the cans have been trimmed, flanged and the base formed automatically. After being conveyed through degreasing and drying operations the cans are picked up by a partial vacuum conveyor system and are fed into lacquering and printing operations (bottom). Four sets of gripper arms remove cans from incoming conveyor and printing mandrel, and afterwards load cans on the outgoing conveyor or next printing mandrel. The system has flexibility to permit handling various sizes of cans and allows a selection of operations.





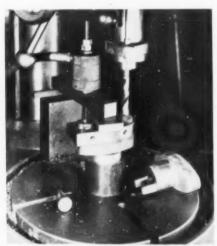


GRINDING OPERATION is expedited by automatic size control. The pickup head gages the critical diameter of the part. When proper size is reached the Electro-

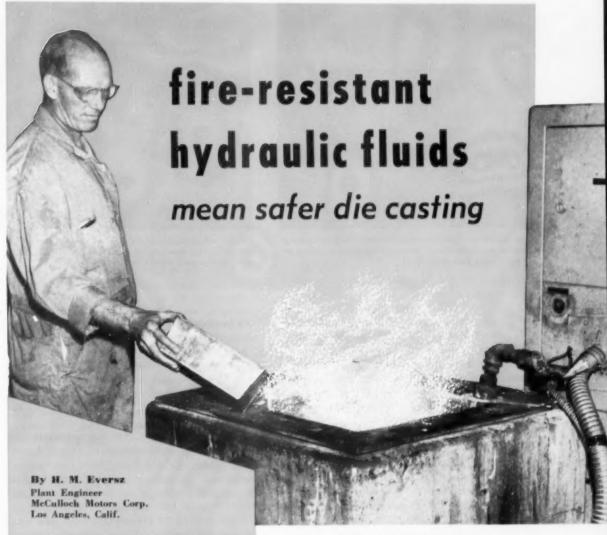
Autosizer signals the machine control; the grinding wheel sparks out and backs off automatically. The finished workpiece can then be unloaded,



SPARK GAP TRACING employed in airfoil milling machine steps up production of contoured turbine blades at General Electric's Small Aircraft Engine Department, Lynn, Mass. Accuracies to 0.0001 inch are secured and a part is machined in 20 to 30 minutes. The setup is particularly valuable for small lots needed for development and prototype work.



DRILLING refrigerator valve bodies is speeded by new tooling setup at H. A. Phillips Co., Chicago. Operation time is cut by half with the introduction of power clamping replacing manual methods. The air-hydraulic Wilton PowRlock quickly locks the workpiece in position, permits turning the valve body 180 deg for drilling of the second hole.



Disastrous industrial fires have speeded the development of fire-resistant hydraulic fluids to the point where they are no longer unusual. The author describes one commercially available fluid and his company's experience in using it in machines for die easting aluminum and magnesium.

A fire-resistant hydraulic fluid is being poured directly into a pot of molten magnesium. The fluid formed into small globules that raced around the surface and turned into steam. The residual oil burned weakly until consumed.

Over the past two years we have had hydraulic fluid leakage, line breaks and valve ruptures, but not once have we experienced any fires, even when the fluid splashed into molten magnesium. This record has been possible because we have been using an emulsion type fire-resistant hydraulic fluid in all our die-casting machines.

We are proud of this safety record, but it wasn't

always this way. Prior to the use of the fireresistant hydraulic fluid, almost all of our machines were charged with a straight mineral oil. One day, the body casting of a check valve split and mineral oil, under close to 1000-psi pressure, sprayed out over the surrounding area. The air-oil mixture hit the pot of molten aluminum and ignited instantaneously. More than 100 gallons of the oil went up in smoke.

Because of the flash back, fire spread to the front of the main electrical distribution panel. Heavily smoke-laden air, having reduced electrical resist-



The machine operator removes a finished easting from a machine that is actuated by an emulsion type fire-resistant hydraulic fluid.



Bright yellow color of one type of fire-resistant fluid simplifies the spotting of line leaks. Machine operators notice and report leaks more readily.

ance, penetrated the panel. When the 4160-v line was grounded, all of the fuses blew in the main transformer.

While the die-casting machine was not seriously damaged, we had to rewire and repipe the machine, repaint the burned shop areas and have the transformer entirely rebuilt. Fortunately, no workers were injured but this accident pointed up our need for a fire-resistant fluid to protect personnel, equipment and building.

Three different types of fire-resistant hydraulic fluids were tested in our plant. In less than six months two of them were discarded for the following reasons: high cost for initial purchase and make-up—fluid attack on packing seals resulted in excessive joint leakage—and the discovery that to use the fluids would have required special, expensive components. In addition, one fluid caused poor and sluggish machine operation when excessive foam filled the lines. The other fluid didn't work well over 1200 psi; it had a tendency to separate out and cavitation ruined several costly pumps.

The third fire-resistant fluid, with which we have now charged our 14 die-casting machines, is Irus Fluid 902. Developed by the Shell Oil Co., it is a combination of water, petroleum oils and emulsifying agents. It was thoroughly tested in two die-casting machines for over six months under all conceivable operating conditions. Its fire resistance, lubricating properties, hydraulic efficiency, equipment compatability and economy were the factors that led us to use it in all our machines.

Our 14 die-casting machines have operating pressures ranging from 800 to 1800 psi. Vane pumps on these machines range in capacity from 7½ to 30 hp, and are standard high-pressure low-volume types operating at around 1800 psi.

Changeover Procedures: Tests revealed that the fluid operated well with existing machine components, and for that reason we did not have to modify or change lines, pumps, valves, cylinders. O-ring seals, or gaskets. For best results, special techniques were required for the change-over from both the mineral oil we normally used and the fire-resistant fluids we had tested.

For machines charged with mineral oil, the old oil was drained, tanks were wiped out and the system charged with Irus fluid. After two weeks of operation, this charge was drained and the final fill inserted. Because of the possibility of air entrapment, lines were not blown out,

Since none of the fire-resistant fluids now marketed are compatible, it was necessary to completely remove all traces of the previous fluid from the machines we had used for tests. Experience has shown that any mixing of different type fluids will cause emulsion instabilty and increase the possibility of water separation.

Also, thorough cleaning of the systems was mandatory in order to avoid contamination of the emulsion fluid. For each machine change-over, therefore, systematic cleaning included the hand wiping of sumps, separation of lines at low spots and draining of accumulators.

It should be noted that the first charge of the emulsion type fluid acts as the flushing medium and is drained while it is warm and has low viscosity. We were advised against the use of systemflushing compounds because of additives that could possibly affect fluid stability.

Performance: Wear patterns that result when an emulsion type fluid is used in standard hydraulic pumps are noticeably different from those encountered with conventional hydraulic fluids. Wear has been slightly higher than with straight mineral oils but much less than that encountered with the other fire-resistant fluids tested. We also had some minor pump trouble, but this was traced to an inadequate suction screen capacity plus some flow resistance due to intricate and tortuous suction piping that prevented an adequate flow of fluid to the pump. We eliminated this problem by first making changes in the piping and then increasing the suction screen capacity.

Another factor to be considered is the proper operating temperature of the fluid. Shell engineers recommend that the bulk-oil temperature not exceed 150 F in order to control excessive loss of water through evaporation. We have found that a range from 100 to 130 F gives satisfactory operation.

When our die-casting machines are run around the clock, the fluid has to be cooled. Conversely, when the machines stand idle for any length of time (such as over week ends), the temperature of the fluid drops to 40-70 F and its viscosity rises. We plan to install thermostatically controlled cartridge heaters in the reservoirs. When the fluid temperature rises above 130 F, coolers will be actuated; when the temperature drops, the heaters will take over to maintain the proper fluid viscosity.

Constant air pressure is maintained by a breather in the fluid reservoir. This breather is necessary since the level of fluid in the reservoir varies somewhat while the machine is operating. By introducing the air to the reservoir, the rest of the system can be closed and there is no chance of starving the pump if the proper fluid level is maintained when machine is inactive.

Maintenance: Since May 1956, we have been averaging about 3½ barrels of the emulsion type fluid monthly for all 14 machines. This exceptionally low amount for make-up can be attributed to two factors: the fluid's color and competent maintenance.

Irus fluid is colored a bright yellow which turns milky in use. The color is a decided advantage in speeding location of fluid leaks. Even a small patch of leaking fluid is noticeable at a distance, and alerts the maintenance crew to the need for repairs.

Our maintenance crew consists of one full-time mechanic and one electrician who follow a two-fold program. They check for leaks and machine malfunction, and aid in the setup of dies from low to high position or vice versa. It is necessary to add or remove two spools that lead from the supply lines to the cylinders when dies are changed on most of the machines. This opening of the system accounts for a sizable part of the hydraulic fluid loss.

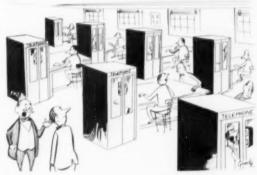
No Hazard: Earlier, we mentioned that the emulsion type fluid proved fire resistant even when splashed on molten magnesium. This may surprise some people because of the fluid's water content, but we feel that there has been too much "scare" talk about the use of water-based hydraulic fluids in machines die casting magnesium. Actually, there is little difficulty in the safe handling of magnesium.

Since we use magnesium for about one-third the total of parts for our commercial products, we had to make sure that Irus fluid would not represent a fire hazard in and around the machines die casting this metal. The best way to test the fluid was to expose it to molten magnesium and see what happened.

First, the fluid was sprayed directly onto the molten metal by means of a portable spray gun. Water was instantly given off as steam. After dissipation of the water content, the oil burned with a small flame that died out quickly. It was apparent that a fine spray of the fluid on molten magnesium did not represent a fire hazard.

Following the spray test, a worker poured about a pint of the fluid into the molten magnesium. The fluid formed into small globules that raced around the surface and finally collected into one mass in the center of the pot. At this point, the fluid vaporized. After the water content of the fluid disappeared, the oil burned for a short while but the flickering flames were restricted to the pot.

With the increasing use of oil-hydraulic power in many branches of industry, it is paramount that consideration be given to the reduction of fire hazards. The use of flammable hydraulic fluids in the presence of flames, sparks and heated or molten metal places workers, equipment and the plant itself in jeopardy. We have evaluated several fire-resistant hydraulic fluids and decided upon the one that has proved most satisfactory for us.



"We couldn't give 'em private offices so we did the next best thing."

# TOOL LIFE extended



By Paul Topelian V.P. and Dir. of Research Tiarco Corp. Clark, N. J.

Fig. 1. Chrome-plated saw band cuts fiberglass wingtip reinforcement cleanly and quickly.

Impressive cost savings are being registered with cutting tools protected by a hard-chrome plate applied directly to chemically treated base metals. Some typical examples from industry illustrate potential of such processed tools.

M ACHINING GLASS-FILLED plastics, filing annealed high-carbon high-chrome die blanks, drilling condenser plates and breaking concrete are not similar processes but they all result in wear of cutting tools. A technique that would reduce wear for any of these processes would interest numerous tool engineers. A process that reduces wear for all of them has universal appeal. Chromium plating of tools used in these processes has extended tool life and reduced costs.

The particular chrome plate that has achieved these results is unusual because, by chemically pretreating the base metal, it can be applied directly to steel, aluminum, titanium, brass, etc., without the need for intermediate flash coats of other metals. This electrochemical plating method is called the Kromolloy Process.

### Typical Applications

Abrasive action of the glass in laminated plastics seriously reduces the life of a cutting tool. If extensive cutting is required, tool and sharpening costs can be high. Grumman Aircraft, for example can cut only one fiberglass wing-tip reinforcement with a conventional band-saw blade. Because blade costs were high and considerable time was lost changing blades, company engineers searched for a less expensive cutting method. They even considered the use of diamond-edged blades costing \$4 per inch.

Band-saw blades from regular stock were Kromolloy processed with startling results. With a treated blade of the same type that could only cut one splitter, 32 splitters were cut, Fig. 1, and trimmed without recognizable dulling. These splitters varied in thickness from  $\frac{1}{8}$  to  $\frac{3}{8}$  inch. This one treated saw band cut 266 lineal feet and trimmed 257 lineal feet of flash from the fiberglass parts. It was noted that the treated band cut cleanly without any tendency

# by hard-chrome plate

toward burning of the fiberglass workple es.

Although they had achieved success with hardchrome plating of files before this incident, Tiarco suddenly realized that the entire cutting-tool field was open for further research and appraisal. If chromium plating could add substantial life to files and saw bands, similar results should be possible with other cutting tools. Tests conducted in production operations show that this is true.

Drilling tests were run by Worthington Corp. on actual shop orders for condenser support plates. It had already been established that 30 7/8-inch holes could be drilled through stacks of four 7/8inch plates by regular untreated drills. In the first test with a treated drill, approximately 500 holes were drilled under standard conditions. After regrinding, 200 more holes were made before sharpening was again necessary. A second treated drill made about 400 holes before it required sharpening. For some of these holes, higher speeds and feeds were used but hole finish was rough. Subsequent tests on plated drills-and some other tools have shown that they should be operated under conditions that have proved the best for untreated tools in the same application.

Based on the success of the first tests, Worthington engineers ran another series of tests to determine regrinding characteristics and possible cost savings. Two ¾-inch plated, piloted drills were used on a stack of five ¾-inch plates. Both drills were sharpened after each had drilled about 240 holes. After sharpening, each drill produced about 150 more acceptable holes. A third group of about 60 holes was drilled by each tool after a final sharpening. Drilled holes had finishes ranging between 150 and 200 microinches, rms.

Immediately recognized was the saving of 11 regrinds and 11 drill changes over the series of 450 holes per drill. No estimate was made of drill savings but the elimination of 11 regrinds represents a saving of \$8.80 per treated drill.

Tests have also been made with treated drills on fiberglass parts, Fig. 2. Unplated drills required pilot holes and produced about 40 holes before sharpening was necessary. Plated drills made about 340 holes of better quality and pilot drilling was unnecessary.

Although it is outside the metalworking field, breaking concrete with a jackhammer represents rigorous tool conditions. Concrete is anything but homogeneous, having stone aggregate and metal reinforcing bars scattered throughout: The steel wedge point of an 80-lb pneumatic road-breaking drill was chromium plated and tested against an untreated tool. After 40 hours of breaking 8-inch reinforced concrete, the unprocessed point had decreased 1½ inches in length and needed resharpening. The plated point had negligible wear and was

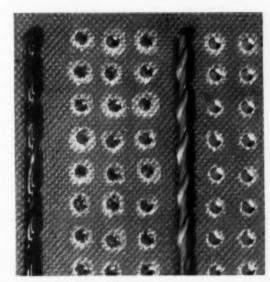


Fig. 2. Drilling of fiberglass is a difficult operation. The chrome-plated drill, right, makes many more holes with much better quality.

still usable for many more hours of work.

The biggest mass of data has been accumulated on the treatment of files by the Kromolloy process. Although the chromium plate is only 0.000050 inch thick, processed files at least double the life of the same file unprocessed. In addition to increased life, chromium-plated files exhibit a nonclogging characteristic, Fig. 3, which may be one of the major factors leading to increased life. Where the correct file for a job is replaced by a chrome-plated duplicate, life will increase and clogging will not be a problem. Also, treated files are rust resistant, dissipate heat well from cutting edges and are up

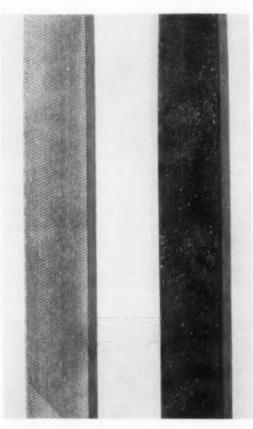


Fig. 3. Unprocessed file, right, exhibits clogging after 500 strokes on metal, while the treated file is still clean after the same use.

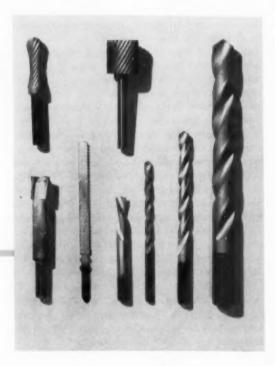
Fig. 4. During investigation into the uses for chrome-plated tools, these typical tools were treated and then studied in operation. Results were good. to 10 points harder (70-72 R<sub>C</sub>) than standard files.

At the loomworks of Crompton & Knowles, engineering studies show that chrome-plated files have been in daily use for two months and have an estimated life of one more month. Under the same use, unplated files must be discarded after one month. When chrome-plated files are used to file bearing pads at this company, they last 12 to 13 days. Unprocessed files have an average life of 3 to 4 days on the same job.

After using chromium-plated files for nine months, Reed Rolled Thread Die Co. found that file consumption for general use was cut in half. Where the treated files were used on annealed high-carbon high-chrome die blanks, consumption dropped to 25 percent of the former amount.

This process of plating cutting tools is not a "miracle" solution for all the problems of the small-cutting-tool industry. However, in the vast majority of instances where chrome-plated tool have been used, service lives of the tools, Fig. 4, have been materially extended. In all instances, the use of treated tools has been found economical.

Plating the tool does not alter optimum feed and speed rates for machine tools, and it does not change the type of file selected for a particular job. These are known limitations of this technique. Continuing investigation will determine if there are other limitations, such as the peculiarities of certain metals or alloys, that will require different techniques.



# modular construction cuts design and fabrication costs

By T. W. Black Associate Editor

Component standardization and modular construction have resulted in more efficient fabrication of automatic plating machines. A full-size mock-up has helped to solve design and manufacturing problems and has resulted in greatly improved operation.

Manufacture of automatic plating machines is a highly competitive business. Two years ago, the management of Wagner Brothers in Detroit made an extensive survey to determine the best ways to obtain a larger share of the market for their product. Two basic decisions were made: first, to design machines with as many improved features as possible; and second, to manufacture these machines at the lowest possible cost, keeping the prices of the new machines at attractive levels.

As is the case with many products, standardization appeared to be one of the most effective means for cutting costs. However, each plating machine is a custom installation, tailored to fit specific customer requirements. The length, height, width and number of plating tanks vary from machine to machine, depending upon the dimensions and weight of the parts being plated, batch size, and cleaning and plating process. Over-all length of plating machines is also a variable; some machines are more than eighty feet long.

Steel I-beams, welded together, Fig. 1, are used to fabricate the base and size members of most large automatic plating machines. This framework supports the tanks and elevator and transfer



Fig. 1. Framework of automatic plating machine is assembled and welded on special fixtures.

mechanisms and it, too, is normally constructed on a custom basis.

The pattern of transfer of racks from tank to tank or station to station is another variable. A typical plating machine has a number of individual tanks, each accommodating one rack or batch of parts. It also has several longer tanks which hold a relatively large number of racks, Fig. 2. Thus, two types of transfer mechanisms must be provided: one to lift a rack from one tank, move it over the next tank and lower it into that tank; the other to index racks from station to station in long tanks. Individual and multiple-station tanks may be positioned in any order dictated by processing requirements.

It was apparent to Wagner's management that construction of completely standardized machines was out of the question. At the same time, there were many machine components which could be standardized. Accordingly, Wagner design engineers were asked to consider standardization as much as practical in the design of improved machines. Further, they were to keep in mind ease of manufacture and ease of fabrication in all design work.

During the design period, there was close cooperation between design engineers, customer service engineers and manufacturing personnel. The informal interchange of ideas between departments, coupled with close engineering study of possible design and manufacturing improvements, was an important factor in the success of the development program.

One of the first design concepts adopted was modular or "building block" construction, in which a machine is built up from standard sections. An example of the advantages of modular construction is found in the fabrication of the framework. Formerly, it was necessary to cut the I-beams to length individually and weld them together on special fixtures. With building block construction, I-beams are ordered from the manufacturer in a series of standard lengths. These precut structural members are tack-welded on a universal fixture which accommodates frameworks from 12 to 40 feet long, and from 4 to 9½ feet high, Fig. 3. After tack welding, frameworks are lowered to the floor

for final welding. Manpower requirements for assembly and welding have been cut by two-thirds and accuracy has been improved. The repetitive modular pattern of the framework is evident in Fig. 4.

A further step in cutting fabrication costs was the design of all basic components as standard subassemblies which are put together in the shop prior to assembly on the machine. Elevators, for instance, are completely assembled package units which can be mounted or replaced on a machine in 45 minutes by unskilled labor. Transfer mechanisms, rack carriers and all other mechanical components are also designed as standard subassemblies for installation as package units or for rapid assembly on the machine itself. All individual component parts have also been standardized.

Design simplification and standardization have been extended even to such components as the friction clamps which support the cathode assembly. On previous machines, cathodes were supported by brackets which required drilling and tapping 22 holes during assembly. The friction clamp requires only two drilled-and-tapped holes. These machining operations are performed prior to assembly of the machine. A further advantage of the friction clamp fastening method is that the clamps can be readily adjusted during assembly to move the cathode rail up or down, in or out, or to tilt it at any desired angle from the vertical to establish full contact between the shoe of the carrier and the cathode rail surface.

Modular construction has reduced design time by 65 percent. Knowing the rack sizes needed and the number and sizes of tanks, machine designers can readily visualize the required machine in terms of standard modules. Machine design is essentially a matter of combining these modules.

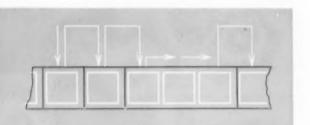
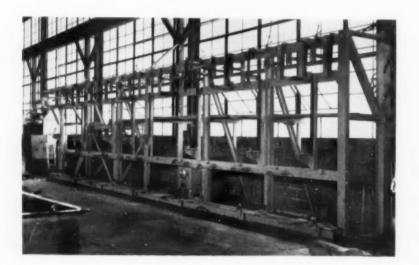


Fig. 2. (above) In most plating machines, single and multiple tanks are interspersed. Movement of racks is shown by arrows.

Fig. 3. (right) Universal welding fixture for assembling machine framework. Framework is tackwelded on this fixture, then transferred to horizontal fixture for final welding operations.



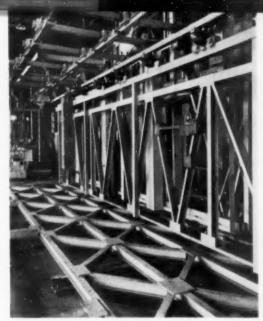


Fig. 4. Modular framework is built from precut structural members. The same triangular pattern is repeated throughout length of machine.

Aluminum lofts, scaled to an accuracy of 0.003 inch and containing every modular structural item found on automatic plating machines, are used in preparing machine designs, Fig. 5. Because of the accuracy of the lofts, it is possible to plan machines with certainty that all components will fit properly at assembly. Drawings of many standard components, done on translucent plastic, can be spliced into vellum machine drawings, eliminating tedious tracing. The plastic drawings, which can be reposed indefinitely, are especially valuable in pre-

paring machine designs for quotation purposes, making it possible to furnish a customer with a fully detailed design quickly and at minimum cost.

Functional improvements in automatic plating machines, involving, in most cases, completely new component designs, were made concurrently with the development of modular construction. When component designs appeared satisfactory on paper, prototype models were made up and tested on the full-size mock-up which serves Wagner engineers as a development laboratory, Fig. 6. As the models were cycled through extensive tests under simulated production conditions, functional characteristics, accessibility for maintenance and manufacturing problems were thoroughly evaluated. Prototype models were fabricated as weldments. However, when designs were approved as standard, patterns were made and the components were produced as castings.

Standardization has made it possible to manufacture components on a production basis, with evident savings over custom fabrication. Relatively large quantities of parts are made up at one time and kept in stock for use in future machine construction and to serve as a bank of readily available replacement parts for existing machines.

In designing a new machine, Wagner engineers were concerned with solving several problems which have always plagued users of automatic



plating equipment. Perhaps the most important of these is the smoothness of the elevating and transferring motions. On earlier machines, for instance, sudden acceleration and deceleration of the racks sometimes caused parts to fall off the racks. On the new machine, power for horizontal carriage travel is supplied by a special hydromotor which achieves simple harmonic motion and extreme smoothness in acceleration and deceleration. Arms attached to the hydromotor move with constant angular velocity through a 180-degree arc, driving

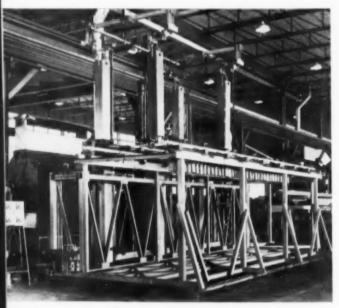


Fig. 6. Full-size mock-up consists of one elevator section and one pusher section. Elevator section is in "up" position. Four 300-lb weights are lifted simultaneously to duplicate production loads.

the carriage through connecting rods. Length of transfer can be adjusted and controlled within close limits. The elevator mechanism is also hydraulically powered and gives smooth acceleration and deceleration. Sufficient power has been provided to permit one elevator to lift a large number of racks, thus cutting down on the total number of elevators required in a complete machine.

Another problem in plating involves the tendency for crystalline deposits to build up on machine components directly above plating solutions. These deposits can cause malfunctions of moving parts. In the modular machine, this problem has been avoided by "designing out" any moving parts above the tanks. This also eliminates the possibility of lubricants dripping into plating solutions—a common cause of contamination.

Floor space requirements for automatic plating machines are high and Wagner engineers devoted considerable thought to possible means of cutting down over-all machine length. This was accomplished by providing a compensating assembly which permits closer spacing of racks in multiple-station tanks than is possible when racks are moved between individual tanks. The closer spacing also allows currents of higher density to be used without burning the corners of the work. More retal can be applied at each station so the total number of stations can often be reduced.

One of the new automatic plating machines is already in successful operation and several others are scheduled for installation in the near future. As anticipated, modular construction and standardization have kept manufacturing costs in line and extensive functional testing on the full-scale mockup has paid off in terms of a better product.

# Stretch Forming Technique Conserves Titanium

Tendency of titanium to crack during stretch forming operations wherever there are rough edges or shear fractures has, for some time, proved a handicap to its industrial users. At the same time, with titanium as precious as silver, it was an expensive loss. Now a new method of preparing edges of the metal has been developed which provides sizable savings in tools and man hours as well as titanium.

As a consequence, mortality rate of pieces on stretch forming jobs has been reduced from as high as 75 percent to only one percent. The technique also has increased quality of titanium parts and reduced number of production hours to arrive at desired quality. Result is extensive savings in titanium for the defense industry, and, consequently, a reduction in cost of aircraft.

The device, developed by North American Aviation, Inc. to cut production costs, mechanically pulls strips of titanium through a series of graduated cutting tools radiused to give the titanium a smooth, rounded edge.

Savings in tools and man hours have been unexpectedly high. Formerly, when hand filing was used, the average tool usage was six vixen files per man per day with the result of 32 acceptable parts. The newer technique allows the same number of parts to be produced in only one hour—and edges are considerably better. To meet the work output that one man can now produce with one machine, it would take eight men and 48 files.

# Forming Titanium Sheet

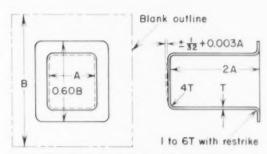


Fig. 1. Typical hot-formed titanium part.

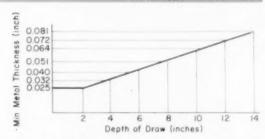


Fig. 2. Relationship between material thickness and depth of draw for hot-formed titanium sheet.

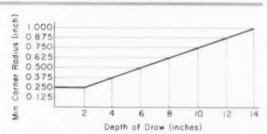


Fig. 3. Relationship between bottom radius and depth of draw for hot-formed titanium sheet.

T ITANIUM IS FORMED by the same methods as other metals except that forming is done hot. During forming, the metal is held at 1000-1350 F. for four to eight minutes.

At these temperatures, heat-resistant drawing lubricants such as graphite are used in place of the common petroleum-base lubricants. Dies must be of materials which will withstand high temperatures. If a die will be subjected to pressure during forming, creep resistance is also important. Differences between the coefficients of thermal expansion of titanium and the die material is another factor to be considered in die design.

In drawing titanium sheet at high temperatures, shapes can be more complicated and draws deeper, Fig. 1, than with most other metals. Springback is never a problem and no intermediate annealing operations are required.

A further advantage of hot forming is that there is no hydrogen pickup, which might cause embrittlement of the metal. When titanium is cold drawn and annealed following the draw, there is real danger of embrittlement. Hydrogen pickup depends more upon time at temperature than upon the temperature to which the material is heated. Thus hot drawing with short time-at-temperature is much less likely to cause embrittlement than cold drawing followed by long time-at-temperature intermediate annealing operations.

Minimum metal thicknesses and minimum vertical corner radii for drawing pure titanium sheet to various depths are shown in Figs. 2 and 3. Formability of titanium alloys is somewhat less than that of pure titanium. Accordingly, the limits shown in the graphs are not applicable to alloys.

Reprinted from Magnesium, published by Brooks & Perkins, Inc., Detroit, Mich.

# heat and corrosion-resistant

# casting materials

Standard designations and chemical-composition ranges for heat and corrosion-resistant casting-alloys are listed in the accompanying table. Corrosion-resistant alloys are identified by the initial letter "C." These alloys resist corrosive attack at temperatures up to 1200 F. Heat-resistant alloys, designated by the initial letter "H," are for applications where metal temperatures exceed 1200 F.

The second letter in the designation represents

the nominal chromium-nickel type. Nickel content increases from "A" to "X." For example, "F" stands for a 19 percent Cr-9 percent Ni alloy, "K" for a 25 percent Cr-20 percent Ni alloy, and "W" for a 12 percent Cr-60 percent Ni alloy.

Carbon content is indicated by numerals following the hyphen. These numerals represent the maximum carbon content of corrosion-resistant alloys and the midpoint of a  $\pm$  0.10 percent carbon

> range for the heat-resistant alloys.

If special elements are included in the metal composition, they are shown by a letter following the numerals. Thus "CF-8M" is an alloy for corrosion-resistant service of the 19 percent Cr-9 percent Ni type, with a maximum carbon content of 0.03 percent, with some molybdenum.

Most of the standard grades listed are covered for general applications by ASTM specifications A 296-55 and A 297-55. ASTM specifications A 217-55, A 351-52T, A 362-52T, B 190-50 and B 207-50 also apply to some of the grades.

Wrought alloy type numbers are listed only for the convenience of those who want to determine corresponding wrought and cast grades. Since the cast-alloy composition ranges are not the same as the wrought composition ranges, castalloy designations should be used when specifying casting materials.

Data turnshed by Alloy Casting Institute Mineola, N. Y

# Standard Designations and Chemical-Composition Ranges for Heat and Corrosion-Resistant Casting Materials

Cast	Wrought			C	omposit	ion (perce	nt)*		
Alloy Designation	Alloy Type	С	Mn (max.)	Si (max.)	P (max.)	S (max.)	Cr	Ni	Other Elements
CA-15 CA-40 CB-30 CC-50	410 420 431 446	0.15 max. 0.20 0.40 0.30 max. 0.50 max.	1 00 1 00 1 00 1 00	1.50 1.50 1.00 1.00	0.04 0.04 0.04 0.04	0.04 0.04 0.04 0.04	11.5-14 11.5-14 18-22 26-30	1 max. 1 max. 2 max. 4 max.	Mo 0.5 max † Mo 0.5 max.†
CE-30 CF-4 CF-8 CF-20	304L 304 302	0.30 max. 0.040 max 0.08 max 0.20 max.	1.50 1.50 1.50 1.50	2 00 2.00 2 00 2 00	0.04 0.04 0.04 0.04	0.04 0.04 0.04 0.04	26-30 17-21 18-21 18-21	8-11 8-12 8-11 8-11	=
CF-4M CF-8M CF-12M CF-8C	3161 316 316 347	0 040 max 0 08 max 0 12 max 0 08 max	1.50 1.50 1.50 1.50	1.50 1.50 1.50 2.00	0.04 0.04 0.04 0.04	0.04 0.04 0.04 0.04	17-21 18-21 18-21 18-21	9-13 9-12 9-12 9-12	Mo 2.0-3.0 Mo 2.0-3.0 Mo 2.0-3.0 Cb 8xC min. 1.0 max., or Cb-Ta 10xC min. 1.35 max.
CF-1GF	303	0.16 max	1.50	2.00	0.17	0.04	18.21	9-12	Mo 1.5 max Se 0.20-0.35
CF-16Fa CH-20 CK-20 CN-7M	303 309 310	0 16 man 0 20 man 0 20 max 0 07 max	1 50 1 50 1 50 1 50	2 00 2 00 2 00	0 04 0 04 0 04 0 04	0 20-0.40 0.04 0.04 0.04	18-21 22-26 23-27 18-22	9-12 12-15 19-22 21-31	Mo-Cu
HG HD HE	446 327	0.20 max 0.50 max 0.50 max 0.20-0.50	0.35-0.65 1.00 1.50 2.00	1 00 2 00 2 00 2 00	0 04 0 04 0 04 0 04	0 04 0 04 0 04 0 04	8 10 26 30 26 30 26 30	4 m x 4-7 8-11	Mo 0.50 1 20 Mo 0.5 max 1 Mo 0.5 max 1 Mo 0.5 max 1
HF HH	302B 309	0 20 0 40 0 20 0 50	2 00 2 00	2.00	0.04	0.04	19-23 24-28	9·12 11·14	Mo 0.5 max † Mo 0.5 max.† N 0.2 max.
HK	310	0 20-0 50 0 20-0 60	2.00	2.00	0.04	0.04 0.04	26-30 24-28	14-18 18-22	Mo 0.5 max 1 Mo 0.5 max.1
HL HN HT HU	330	0 20-0 60 0 20-0 50 0 35 0 75 0 35-0 75	2 00 2 00 2 00 2 00	2 00 2 00 2 50 2 50	0 04 0 04 0 04 0 04	0.04 0.04 0.04 0.04	28-32 19-23 13-17 17-21	18-22 23-27 33 37 37-41	Mo 0.5 max.† Mo 0.5 max.† Mo 0.5 max.† Mo 0.5 max.†
HW HX	=	0.35-0.75 0.35-0.75	2 00 2 00	2.50 2.50	0.04	0.04	10-14 15-19	58-62 64-68	Mo 0.5 max + Mo 0.5 max +

\* Balance Fe.

Mo not intentionally added.

Casting Materials



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# Milwaukee Hosts Semiannual Meeting

Industry and Education
Month 'Kickoff' Featured

ASTE's Board of Directors will hold its semiannual meeting Thursday, October 31 and Friday, November 1 at the Hotel Schroeder in Milwaukee. The meeting will be open to members, as prescribed by the constitution, and those desiring to attend are cordially invited to any or all sessions. Among matters for major consideration will be the 1957-58 budget, suggested national committee projects, and the proposal to reinstitute the Semiannual Convention with its complete schedule of technical and social activities.

Sharing the spotlight with the Board meeting will be Milwaukee chapter's Industry and Education Night program which will be attended by the directors and their wives, as well as guests representing both management and educational interests.

This program will raise the curtain on Industry and Education Month, instituted last November as the climaxing event to the Delegates' Twelve-Month Plan. As they did last year, chapters across the nation will devote their November meetings to familiarizing educators and industrialists with the current role of ASTE and tool engineers in the national economy.

This year Milwaukee's program will reap the benefits of groundwork laid as early as a year and a half ago, when contacts were made with numerous industrialists and educators in the area. The program will revolve around a panel discussion of industry's need for engineers and the role educational institutions are playing in filling this demand. Dr. George A. Parkinson, vice provost of the University of Wisconsin, Milwaukee Extension Division, has been named panel moderator. Dr. Parkinson was acclaimed Engineer of the Year in 1955 by the Engineers' Society of Milwaukee for his considerable and continuing contributions to the engineering profession, civic and patriotic organizations, and to the government and armed services.

Education's stand will be taken by Dr. Arthur B. Drought, dean of engineering at Marquette University. Dr. Drought has a rich background from which to draw. The teaching of engineering subjects, educational administration, wartime radio and radar research work and industrial consultant jobs are but part of his experience. At this time the name of the panelist representing industry's viewpoint has not been disclosed.

A social hour and dinner for an expected 400 guests will precede the panel discussion, with dancing following, to round out the evening's program.



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# Inside Headquarters

Headquarters—national home of ASTE and hub of its activities—supports a staff of some seventy employees who stand ready to carry out the policies of the Society and keep its affairs running smoothly. A tour through Headquarters and an introduction to the men and women working here would be the perfect explanation to a member who is curious about the means by which his Society's objectives are achieved. He could then better understand the work of the staff which handles the thousands of details involved in running an organization of this size, from keeping track of each member and seeing that he receives the services due him, to keeping him informed of the Society's latest plans and developments,

For those who cannot come to Detroit and visit the building at 10700 Puritan Avenue, the next few pages have been devoted to a conducted tour, by word and picture, through the halls and offices of ASTE Headquarters.

### Built-In Safety Factor

Approaching the block-long cinder block building, you will see that the physical structure of the building could easily support a light manufacturing plant. This plan was chosen, back in 1948, so that if the Society did not pull its own weight, the Headquarters building could be sold for a factory, and no loss would be sustained by the building fund subscribers.

As you step through the revolving door, you are welcomed by the receptionist in her switchboard booth. Between calls to and from some of the forty phone stations and their extensions represented on her board, she will assist you in signing in, and start you on your tour down the main hall.

First stop will be the office of the executive secretary. Harry Conrad, who manages the business of the Society, and who therefore heads up all headquarters operations. A frequent visitor from an adjoining office is Allan Ray Putnam, assistant executive secretary and the publishing manager of THE TOOL ENGINEER. As you enter the office to pay your respects, you find that Mr. Putnam is conferring with Mr. Conrad and Gilbert Seeley, the new education director, about plans for further testing of the Advanced Tool Engineering Practices courses, currently high on the list of projects for the National Education Committee. After an introduction to Mr. Seeley, you proceed to the next office. at the extreme end of the hall, where the Technical Publications staff is housed. This group plans, edits and publishes ASTE's handbooks and other technical publications under the direction of Frank Wilson, technical director.

Starting back toward the entrance, you pause at the door of a glass-enclosed cell, where the office manager, Charles Prince, oversees the work of 'Central Office.' Admitting to the classification of 'Jack-of-all-trades,' Mr. Prince's responsibilities reach out to encompass purchasing, budget directing, building management, and personnel administration. In addition, he has general supervision over the membership, data processing, office services and accounting departments, although these departments have their own specific supervisors in addition.

From the vantage point of his office, Mr. Prince can view the membership department, part of the 'tab' room, and the individually-partitioned offices of the staff administrators—for membership and constitution and bylaws, Marvin Bunting; for pro-



Head man at Headquarters is Harry E. Conrad, executive secretary, who is going over a point in the new education program with Education Director Gilbert Seeley, right, and Ray Putnam, assistant executive secretary.

grams, Dick Bacik; for education and professional engineering, Tony Downey; and those of the accountant, Harry Anderson, and the two public relations assistants, Bill Baird and Gloria McClure. A new partitioned office has just been completed for Education Director Seeley at the far end of the large-central office, and through the open door beyond loom the shelves of the stockroom stacked high with all manner of supplies and printed matter.

Keeping tab on 38,000 members, processing dues payments and membership applications, handling all inquiries and orders for materials and services, and maintaining each individual member's historical record on a current basis fall to the lot of the membership department, staffed by a supervisor, Tony Downey, and four helpers. This department receives invaluable aid from 10 mechanical assistants, the IBM machines, in the data processing de-

Inside the technical publications offices, Technical Director Frank Wilson and Associate Technical Publications Editor Jack Holt prepare an article for the next edition of the handbook.



partment. Under the supervision of Archie Knight, this department has the records of the 38,000 members punched in 300,000 tabulating cards, by means of which a great many reports are prepared. The longest of these is the 'Roster,' run off monthly, which shows complete information about each member and provides the National Membership Committee with the complete membership picture.

Back in the main hall, you walk past the offices of Leslie Fletcher, research director and program director; Dick Gebers, public relations manager; and Leonard Abrams, Tool Show manager. As research director, Colonel Fletcher advises the ASTE Research Fund Committee as to likely areas for research, and carries out the committee's expressed desires in the matters of accepting bids on the research to be done and seeing that the projects are carried to their completion by the concerns chosen to perform them. As program director, he contacts speakers in tool engineering and associated fields to participate in the technical programs at ASTE conventions and other special events.

The public relations staff, headed by Dick Gebers, is charged with the job of acquainting the public with ASTE, its functions and its services, and making people everywhere aware of tool engineering as a profession. Other responsibilities involve lending a hand to chapters in their quest for improved pub-

lic relations, as well as aiding national committees by helping them prepare their specialized brochures.

Tool Show Manager Abrams has the gigantic task of sorting through the thousands of requests for space at the Society's Tool Shows, and assigning the existing space in a fair manner to the prospective exhibitors. He takes care of all of the physical arrangements needed to stage a show of this size, from contracting for the exhibition hall to making sure that exhibitors who need special facilities such as water, compressed air, or high voltage electric current, are provided with them.

Leaving Mr. Abrams' office you retrace your steps along the hall past the switchboard and come to the first room beyond the lobby. This is used as a conference room and today is filled with regional advertising managers listening to a pep talk by Michael Jakcsy, business manager of The Toot. Engineer. These men, who cover all sections of the country, sell advertising space in the magazine, floor space for the Tool Show, and contracts for Data Sheets Service.

Mr. Jakesy's own office and its adjoining advertising office are next door to the conference room, and through them pass all matters related to the business end of publishing THE TOOL ENGINEER. Across the hall is the doorway leading to the office services department, supervised by Harold Kull.



Beyond the window in Office Manager Charles Prince's room, a twin glassed office houses the Society's archives, tended by Librarian Grace Corcoran. Here are found records, minutes, and volumes of The Tool Engineer.



With the help of the IBM tabulating equipment, rented by the Society, the data processing department prepares many reports, provides mailing labels, and performs the billing of members' dues, among other operations.

# Printing Presses and Mailing Machines

Here, incoming mail is received and distributed, outgoing mail is stamped and shipped, and many brochures, technical papers, minutes, bulletins, forms, letters, and letterheads are turned out on the two Multilith offset-printing machines. Last year three to four million sheets of paper passed through this department, most of which had been processed

by these machines. The department labels some 40,000 envelopes for The Tool. Engineer each month, and mails 50,000 dues statements and 38,000 membership cards each year, in addition to regular correspondence and mailing of Data Sheets.

The editor of the Data Sheets, George Hargreaves, shares an office with two of the local advertising managers, next to the mail-room door. Just beyond this the main hall ends at a glass-windowed door

Accountant Harry Anderson totals up the day's receipts, while his assistant, Dorothy Granfield, front, types a report. Behind, in the membership department, Marvin Bunting, right, membership committee administrator, and Department Supervisor Tony Downey review an application as helpers Sue Minchin, Sara Graff and Gene Lawson take care of the inquiry answering and filing of member and national committee records.





In the office of Program Director Leslie Fletcher, he and Dick Bacik, right, convention manager, prepare a list of speakers for the 1958 annual convention.

labeled 'Tool Engineer.' Behind this door and at the opposite end of the building from the technical publications offices, all of the magazine editorial work goes on. In the large central office, four secretaries are kept busy by the editors in the smaller surrounding offices. Editor Jack Greve's staff consists of three associates and two assistants, two news editors, and two art editors.

Today the final press sheet has arrived, on which changes can be made for the last time before the presses roll at the printing plant, Cuneo Press,

Next to the program director's office is that of Dick Gebers, public relations manager, who is shown discussing a new brochure with his assistants, Bill Baird and Gloria McClure. The public relations staff at Headquarters assists in preparing such pamphlets for various national committees, in addition to issuing publicity releases about newsworthy Society events.





Tool Show Manager Leonard Abrams and his secretary, Leona Lewandoski, review the space assignments for the Philadelphia Tool Show. Mr. Abrams' responsibilities have been greatly increased with the announcement of the yearnouncement of the yearnouncement of the yearnouncement of the yearnouncement of the starting in 1960, in addition to biennial West Coast Shows.



Michael Jakesy, business manager, heads the conference table at a meeting of regional advertising managers.

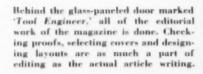


in Milwaukee. Art Editor Michael Babala and his assistant, Tish Pierce, Assistant News Editor Suzanne Olson and Assistant Editor Arthur Colton go over it minutely, to catch any errors or improve the appearance of the layouts.

Outside Mr. Greve's office, Associate Editors Bob Wason and Ted Black confer on the art work for the next month's cover, while Departments Editor Dorothy Taylor checks the arrival of a release with Therese McMahon. Secretary Emma Wendt is doing the finish typing on a manuscript before it is sent to the printers, and Virginia Kuczynski phones in some corrections. Joan Crampton, out of sight behind the files, is sorting tear sheets.

Turning around, you walk back to the entrance. Thus ends your tour of Headquarters, and with it, perhaps, has come a better understanding of the activities that go on and the people that work beneath its roof, making ASTE's projects a reality.

Outgoing mail processed by the office services department has reached as many as 5000 pounds in one day. Supervisor Harold Kull, right, and his helper, Ray Minchin, are also responsible for the tremendous amount of material printed at Headquarters on the offset press in front of them.







# summer outings

August chapter outings were held by the Detroit and Tucson chapters of ASTE. Detroiters enjoyed a golf stag party at Glenn Oaks Country Club, while the Tucson members invited their wives to the El Conquistador Hotel pool for their annual 'splash party.' At the latter affair, splashing was followed by eating and dancing under the stars.

Detroit's golf stag was attended by President 'Rip' Collins, Vice President William Moreland and Director Charles Smillie, in addition to Michigan's Lieutenant Governor Philip A. Hart and Detroit TV and radio personalities. Executive Secretary Harry Conrad was also present, along with Allan Ray Putnam, assistant executive secretary; Charles Prince, office manager; and Bob Reinhardt, assistant technical publications editor, all from head-quarters.

Proceedings at the first tee were enlivened by a clown band that gave appropriate send-offs to those just starting their conquest of the fairways. It paraded behind the president's party, which included Past President Leslie Bellamy, Chapter Chairman Ed Novack and Past Chairman Monta Cox.

Chairman Joseph Gabrick arranged a full day of activity, from golf to numerous games and contests, including fly casting, nail driving, horseshoes and baseball. Golf skills were tested in specialty contests, such as driving the greatest distance, getting closest to the pin on short holes, chipping and putting.

Buffet lunch and a dinner of prime ribs completed the picture of an enjoyable day for the 575 members and guests who attended the festivities.

Guests of Detroit chapter at the annual golf stag, were disk jockey Clark Reid, pointing the way to the first flag; and TV star Toby David, club in hand. Enjoying the clowning are Vice Chairman Tony Rodgers and Joseph Wrobel, cochairman of the golf stag, standing behind Mr. David for safety.



# Illinois Chapters Schedule Tool Engineering Conference

Bradley University Campus in Peoria will be the scene of a tool engineering conference on "Latest Developments," Friday and Saturday, November 1-2. The seventh annual affair of its kind, it will again be sponsored by ASTE's Illinois chapters and the National Education Committee, with the University's departments of industrial and mechanical engineering cooperating.

Friday evening plant tours of Caterpillar Tractor and Keystone Steel and Wire will launch the twoday program, which will continue on the following day with campus tours; technical sessions covering "latest developments" in each of four different fields; luncheon and dinner meetings with talks by outstanding men in educational and industrial fields, as well as in ASTE; and an interest-packed ladies' program.

After a registration and coffee period in the Student Center, and remarks by Dr. A. G. Haussler, Bradley University vice president; Duane Brighton, general chairman of the conference; and Russel E. Gibbs, dean of the College of Engineering, the morning technical programs will commence. The "Latest Developments in Materials Handling" session will include 'future trends' and 'development of an efficient system.' "Latest Developments in Contour Machining" will be highlighted by talks on "Automatic Turret Lathe Controls with Magnetic

Tape" and "Tracer Controls for Milling Equipment," during the alternate morning lecture.

In the afternoon, the latest developments to be described will be those in "Transfer Machines" and "Chip-Removing Tools." Listed under the transfer machine session are "Optimation," "The Transmat Press," and "Product and Process Redesign for Automation," while the meeting on chip-removing tools includes "Diamond Tool Technology," "Modern Drills and Drilling Techniques" and "Latest Tapping Processes."

Featured speakers at the luncheon will be Society President Harold E. Collins and Dr. Harold P. Rodes, Bradley University president, who will discuss the future of engineering education. Scheduled as dinner speakers are ASTE Vice President H. Dale Long and C. A. Woodley, vice president of Caterpillar Tractor Company of Peoria.

Designed to keep the ladies present busy and well-informed, their program boasts campus demonstrations of watch and jewelry making, and the "New Rapid Commercial Sight Reading" exhibit; luncheon at one of Peoria's 'most unusual' restaurants; a program by students of the fine arts department; and the joint banquet with the men.

Inquiries regarding registration can be addressed to E. L. Spring, Box #2259, East Peoria, Illinois, or to D. H. Brighton, 306 W. Melbourne, Peoria.

# In the National Spotlight

# Society Offers Aid to Labor Secretary in Automation-Unemployment Study

Society President Harold E. Collins, in a telegram to Secretary of Labor James Mitchell, offered the services and resources of ASTE to a newly launched Labor Department study of the possible relationship between increasing automation in Michigan and that state's unemployment problem.

The study, proposed by Senator Charles Potter, followed closely upon an announcement by the Michigan Employment Security Commission that 5000 more Detroit workers were without jobs. It will attempt to determine what percentage of this unemployment is caused by automation, and what

solutions can be found to meet the challenge of an increasingly automated Michigan economy.

President Collins' message pointed out that the Society, consisting of tool engineers whose prime concern is with mass-production techniques, has already made investigations into the problem, and is prepared to put considerable data at the disposal of the commission named for the study.

ASTE also sent a telegram to Michigan's Governor Williams, volunteering its services to a special committee created by the governor to make a study similar to that of the Labor Department's.

# Chips and Chatter

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# chips and chatter

### LITTLE RHODY

Principal speaker for the September 5 meeting was A. J. Haygood of the Alcoa Company, who spoke on the almost endless uses of aluminum. Accompanying him was his assistant, Gene Ellinger, who showed a film on tooling for aluminum.

### **PATERSON**

Brownstone Inn was the scene of the September 9 program featuring Fred Jessup and Robert Ellison of Reaction Motors, Incorporated, who lectured and presented films on Rocket Development.

### GREATER NEW YORK

Wright Aeronautical Division of Curtiss-Wright Corporation in Wood-Ridge, New Jersey, was the site of a plant tour by members and guests on September 9. Visitors had the opportunity of seeing the tooling for the manufacture of the various types of aircraft engines made there.



SAN FERNANDO VALLEY—Arthur D. Lewis, who was the chapter's first chairman, accepts a service award plaque from current chairman, Robert Broomell. Signed by Harry Conrad, the inscription on the award congratulates Mr. Lewis, a national director in 1950-51, for his many contributions to ASTE.

—R. E. Ditrick



DENVER—At Denver's tenth anniversary program, past chairmen are shown after they have lit each of the ten candles on the cake. From left, they are: Ben J Hazewinkel, '47-'48; '48-'49; J. R. Matthew, '49-'50; Willard G. Axtell, '50-'51; E. J. Geoffroy, '52-'53; George W. Buckel, '56-'57; Warren Foss, '51-'52; and Clinton J. Helton, '53-'54.

Mats Sjodin

# **ELKHART-GOSHEN**

C. G. Shelly of the DoAll Company presented the program, "The Story of Measurement" at the chapter's September 3 meeting at Concord High School.

## PORTLAND, OREGON

An executive meeting at the Willamette Iron and Steel Company brought all officers and committee chairman together to plan for fall booster meetings.



SAN FERNANDO VALLEY—Coffee speakers who reviewed for members of the newly formed apprenticeship training program soonsored by Los Angeles chapters are from left: E. M. Thomson, apprenticeship program coordinator, Los Angeles City Schools; Ed Cutler, National Education Committee; George Adams, chairman of the apprenticeship program; and H. P. Kamp, California State apprenticeship consultant.

—Robert Ditrick

### SAN DIEGO

A panel of experts drawn from chapter ranks and representing various local plants was on hand to participate in a program called "What's Your Question?" Conceived by Program Chairman Earl Williams, the program was a tremendous success, as measured by extensive audience participation and a 25 percent increase in attendance at this meeting.

### TWIN CITIES

A technical talk on "New Developments in Barrel Finishing" was given by C. J. Glasrud, representative of Minnesota Mining & Manufacturing Company at the September 4 meeting held at Dunwoody Industrial Institute.

### KEYSTONE

At a recent executive meeting, Chairman Joseph Rappenglueck spoke briefly on the history of a barrel factory of a few decades ago, opening a discussion of the transition of a barrel from a materials handling tool to a manufacturing tool, and the process known as "barrel finishing."



WENTWORTH INSTITUTE—Charles W. Moody, right, faculty adviser, receives an engraved plaque for "leadership of Wentworth student chapter" from Robert Chagnon, past student chairman.

### MISSISSIPPI

A recent meeting was devoted to a film and lecture presentation on diamonds. J. Peter Lunzer spoke on the applications of diamond cutting tools and described how new methods of mounting could increase diamond life. An accompanying film told the story of diamond mining operations and the methods used to recover a minute portion of the ore.

### LONG ISLAND

Members heard R. G. Parks of the New York Telephone Company speak on the subject of the "Nike"—guided missile for national defense, on September 9, at the Garden City Hotel.

NORTHWESTERN PENNSYLVANIA Forty members attended the September 5 meeting at which the Eastman Kodak Company film titled "Magnifying Time" was presented by Program Chairman Joe Mallinson. Alfred Schutz, membership chairman, reported on both the recent regional membership meeting in New York and the committee meeting at Headquarters in Detroit.

## GRAND RAPIDS

Annual Ladies Night program was planned for the September meeting at Greendidge Country Club, with golf during the day for those interested. The Reverend Mr. Eugene G. Slep, minister, civic worker and former professional football player, was the featured speaker.

# NIAGARA DISTRICT

Chapter members assembled September 5 at Hotel Queensway to hear Guest Speaker I. J. Kennicott, chief engineer of Kennametal Incorporated, Latrobe, Pennsylvania, talk on "Carbide Tooling Today." He touched on the research of metal cutting with carbide, and outlined the theory of the effects of forces and thermal strains developed in cutting, also explaining the thermocouple method of measuring heat used up in carbide cutting.



# chapter news and views

#### New Alloy Is Topic At San Fernando Valley

Speaker Robert Brookes, vice president of E. Jordan Brookes Company, Incorporated, brought the story of the alloy beryllium-copper to members of the San Fernando Valley chapter at a recent meeting. Listing its many favorable applications in industry, Mr. Brookes described this nonmagnetic material as having high fatigue strength, wear and corrosion resistance and good electrical conductivity. It can be machined, formed and pierced, as well as soldered, brazed and welded. Maximum properties are obtained through heat treatment, he said, and the metal can be plated with cadmium, zinc, tin, copper, chrome, nickel, silver, rhodium, and gold.

A descriptive film titled "How Cigars Are Made" was presented by Mr. Pitt A. Walker of the El Producto Cigar Company. All members present enjoyed smoking a free cigar.

-Robert Ditrick

#### San Gabriel Film Tours Triumph Factory

Fabrication of the English-made Triumph Motorbike was viewed in a film shown to San Gabriel chapter members at their recent meeting. The film pointed up that many of the operations of construction and assembly, which would be done with machine tools in the United States, are still done painstakingly by hand in England. After showing many of the steps comprising the manufacture of one motorbike, the movie showed scenes of motorcycle racing on the world-famous track on the Isle of Man in the Irish Sea.

# Australian Chapter Visits Rolling Mill Operation



SYDNEY—A portion of the Lysaght's Spring Hill Works visited by the chapter recently, showing the four-high, four-stand cold reduction mill. The plant tour followed closely upon a lecture given by Noel Fraser, chief metallurgist of the company, who conducted the tour through the works.

—Ronald L. Cowe

Sydney chapter members, 30 strong, toured the Lysaght's Spring Hill Works at Port Kembla to inspect the plant producing deep-drawing sheet steels. This particular mill is equipped with four-stand, four-high continuous strip mills and single-stand, four-high reversing mills.

During the morning, members visited the continuous stand, beginning at the entry of the strip and observing the joining technique, the pickling processes and rolling, and then passing to the sections engaged in galvanizing and producing corrugated sheet steels for the Australian and Pacific markets. The visitors were entertained at lunch by executives of the mill and, after a lively luncheon discussion, they continued their tour, visiting the singlestand mill. Further technical discussions and an enjoyable afternoon tea completed the day's program.

Of particular interest was the closedcircuit television setup used for quality control, enabling the controller of the four-stand mill to observe the quality of the steel on the shear line approximately half a mile distant. The men were also intrigued by the roll grinding shops and the power that was used.

-Ronald L. Cowee

### Chapter News and Views



LOS ANGELES-A sample part used to illustrate a talk on "Resistance Welding in Action" by W. S. Chapman, center, representing Denton and Amderson Company, is being investigated by Glen Crider, left, program chairman, and Chapter Chairman



PATERSON-Members inspect a cutaway model of a Wright turbo compound reciprocating engine, currently used on all major airlines, which was displayed at one of their meetings.

#### Norton Company Toured By Santa Clara Valley



SANTA CLARA VALLEY-During a tour of the Norton Company, members observe the truing of cup wheels after they have been fired. L. H. Cook, front and left, gets an explanation from George Garrison, plant manager, as others listen in. -Dresden Smith

One of the largest manufacturers of grinding wheels was visited by Santa Clara members recently. Norton Company's Santa Clara plant which, in two years, has grown from six employees to ninety, was host to the men, who were divided into three groups for the trip through the plant. The tour started with the department where the abrasive grain is received, and progressed through the mixing, molding, shaving and firing operations. It then proceeded through the grading, siding, bushing, turning, balancing, speed testing, blotting and, finally, the packing and shipping departments.

G. A. Garrison, plant manager, gave a welcoming address and a descriptive history of the local plant which he described as having been set up to serve the Western market. The tour was followed by the showing of a movie titled "Grits and Grinding."

#### Ralph Eshelman Joins Staff of The Iron Age

Ralph Eshelman is leaving his post as associate editor of THE TOOL ENGI-NEER to become engineering editor of The Iron Age, effective September 15.

A member of THE TOOL ENGI-NEER staff since 1953, Mr. Eshelman will be remembered for his articles on management and production processes. Reprints of his article on career opportunities in tool engineering,



which appeared in Young Men magazine, have received wide circulation as a brochure on vocational opportunities by the National Education Committee of the Society.

#### Muncie Entertains Visiting Dutch Student

At the chapter's annual picnic a special guest was Henk J. Janssen from Delft University in Holland, Acting as host to the student while he is in Muncie is Chapter Secretary Vergil W. Ferratt, engineer at Warner Gear Division, which is one of the two industrial setups which Janssen is studying as a part of the engineering program of his

The young student is the grandson of the founder of the Van Doorn automobile plant in Eindhoven, Holland. The firm builds the DAF truck.



MUNCIE-Special guest at the annual picnic is Henk J. Janssen, left, young Dutch engineering student, who is studying American industrial methods as a requisite to his graduation from Delft University. With him is Vergil W. Ferratt, chapter secretary. - John Schoerer Ben J. Hazewinkel, past national director and presently vice chairman of Los Angeles chapter, and member of the National Progress Committee, was elected president of the Southern California Tool and Die Association. Mr. Hazewinkel was the charter chairman of the Denver chapter.

Edward W. Engle, Chicago, has been appointed development engineer by Kennametal Incorporated of Latrobe, Pennsylvania. He coauthored a paper on the physical properties of ceramic tools presented at the Ceramic Tool Symposium during ASTE's 1957 Houston Convention. He was formerly technical director for the Vascoloy-Ramet Corporation.

James J. Jones, Fort Wayne, has been appointed sales manager of Contract Sales Division of Hartford Special Machinery Company. Karl H. Meyer, Cleveland, has been named manager of manufacturing services at Reliance Electric and Engineering Headquarters.

Albert J. McConnell, Philadelphia, has been appointed assistant branch manager of Crucible Steel Company of America.

Howard A. Arnold, Detroit, has been named manager of product planning and marketing research of General Electric's Metallurgical Products Department.

Thomas Anderson, Santa Ana Valley, will begin studies in September at the University of California at Los Angeles of a two-year executive training program.

John J. Egan, Jr., New Haven, has joined Van Straaten Chemical Company of Chicago as general sales manager. Russell H. Parkhill, Muskegon, has been promoted to the managership of Manning, Maxwell & Moore, Incorporated's local works.

Van F. Belknap, Detroit, has been appointed local sales representative for the Wright Tool and Forge Company, Barberton, Ohio.

George H. Hauser, Long Island, has been elected president of Liberty Aircratt Products Company, a subsidiary of Penn-Texas Corporation.

Bernard C. Dunn, Los Angeles, sales supervisor for milling machines at the Axelson Manufacturing Company, has been assigned additional duties as a sales engineer for lathes in an area from center of Los Angeles, north to Santa Barbara and Bakersfield.

Three district sales managers have recently been appointed by Brown & Sharpe Mfg. Company: Herbert Richardson, Hartford, for the Auburn, Massachusetts territory; Vernon L. Wade, Fairfield County, for industrial products, West Coast; and John A. Rinek, Hartford, for machine tools, also for the West Coast territory.

# members MOVE

Gustave W. Lateste, Montreal, has been appointed chief industrial engineer of Stanley Hardware, The Stanley Works.

Wallace E. Carroll, Rockford, received an honorary degree of doctor of law from Boston College, of which he is an alumnus.

Crawford P. Maxson, Philadelphia, has been appointed head of a group of veteran Standard Pressed Steel salesmen.

Joseph M. Gebel, Detroit, has been appointed manager of the Detroit office of The R. K. LeBlond Machine Tool Company.

Two appointments have been made by Latrobe Steel Company recently: W. G. Dahl has been named regional sales manager and L. M. Teich has been transferred to Hartford branch office in the capacity of district manager.

The Carpenter Steel Company has appointed William J. Stephens, St. Louis, as branch manager in Chicago; M. R. Gerhart, South Bend, succeeds Mr. Stephens in a similar position in St. Louis.

Robert Clark, Mid-Hudson, has been named plant manager of Emhart Manufacturing Company's Hartford-Empire Company Division's plant 3 and its Windsor Street plant. T. G. Gascoigne, San Diego, has joined the West Coast staff of Avildsen Tools and Machines, Incorporated, as chief service engineer.

The appointment of Albert J. Pangburn, Santa Clara Valley, as project engineer of quality engineering in IBM's Endicott plant has been announced. He has been project manufacturing engineer in the company's San Jose plant in California.

William E. Vogel, Detroit, has been appointed assistant manager of Atlas Drop Forge Company of Lansing.

Alfred M. La Com, San Fernando, has been named general sales manager of Collins Microflat Company, Hawthorne, California.

Announcement was made of the appointment of **Richard A. Powley**, Chicago, to the presidency of the Pesco Products Division of Borg-Warner Corporation in Bedford, Ohio.

George D. Klump, Worcester, has been named manager of manufacturing engineering for General Electric Company's Small Steam Turbine department.

L. C. Hill, Pittsburgh, has been elected chairman of the Pittsburgh chapter, American Society for Metals.

Lowell Jensen, Racine, has been appointed works manager at Famco Machine Company.

#### Positions Available

TOOL DESTGNER—Experienced in designing jigs, fixtures, gages, rotary indexing fixtures and automated assembly fixtures for high-volume production. Due to this high-production requirement, the designer must be able to design class "A" tools. San Francisco manufacturer, steady employment, progressing and expanding company, international distribution, modern plant and equipment. Excellent company benefits. Please state age, education and minimum salary requirements in first letter. Include detailed resume of experience. Schlage Lock Co., P. O. Box 3324, San Francisco, Calif.

PROJECT ENGINEER—Excellent opportunity for M. E. experienced in planning and estimating cost of parts and tooling. Familiarity with design and operation of progressive dies. San Francisco manufacturer, steady employment, progressive and expanding company, international distribution, modern plant and equipment. Excellent company benefits. Please state age, education and minimum salary requirements in first letter. Include detailed resume of experience. Schlage Lock Co., P. O. Box 3324, San Francisco, Calif.

# Coming Meetings



1958 ASTE Tool Show
26th Annual Meeting
May 1-8
Philadelphia Convention Center

#### National

Semi-Annual Meeting—Oct. 31 and Nov. 1, Milwaukee. Included in weekend program—Milwaukee chapter's Kickoff Industry and Education Night program. Nov. 1, designating the start of Industry and Education Month.

#### Conference

Bradley University—Nov. 2, Peoria.

Illinois Chapters' Annual Tool Engineering Conference.

#### Chapter

- CALUMET AREA—Oct. 15, 6:30 p.m., Phil Smidt's, 1205 Calumet, Whiting.
- Cedar Rapids—Oct. 10, 6 p.m., Sheraton-Montrose Hotel. "Barrel Finishing—Equipment and Methods" by representative of Almco Div. of Queen Stove Works, Inc. Social period followed by dinner at 6:30 and technical session at 7:30.
- CINCINNATI—October 8, 8 p.m. Tour of the Champion Paper Co. Dinner at Eton Manor, Hamilton.
- DES MOINES—Oct. 9, 7 p.m., Des Moines Country Club. "Plastics as a Hobby" by Mrs. Van Horn. Movie entitled "Designing and Building the Ford Motor Car." Ladies night.

- ELMBRA—Oct. 7, 7 p.m., Joe's Restaurant, Ithaca. "Induction Heating" by Dr. H. B. Osborn, Jr. technical director, Tocco Div., Ohio Crankshaft Co., and past president of ASTE.
- Ente.—Oct. 1, 6:30 p.m., Alliance Technical Institute, Cambridge Springs.
  "Plastic Boat Building" by W. Schilling, owner, Molded Fiber Glass Boat Co. Talk to be accompanied by a film. Tour of the boat company after the meeting.
- EVANSVILLE—Oct. 14, 6:30 p.m. Joint meeting of quality control engineers and ASTE. Also Executive Night, DoAll's "Story of Measuring" by C. G. Schelly,
- GREATER NEW YORK—Oct. 7, 8:30 p.m., Hotel New Yorker. "Flo Turning" by Arthur A. Merry, chief of advanced tool engineering, Pratt & Whitney Aircraft Div., United Aircraft Co.
- Hamilton District—Oct. 11, 6:30 p.m., Fischer's Hotel. "Machine Tools and the Tool Engineer" by E. W. Dickett, engineer, Sundstrand Machine Tool Co.
- HARTFORD—Oct. 7, 6 p.m.. City Club of Hartford. "Automation by Air— Air Tools" by representative of The Bellows Co. Movies of air equipment.
- Jackson—Oct. 14, 7:30 p.m., plant tour Ford Motor Co. engine plant. Dearborn, Mich. Group will meet at Mercury Administration cafeteria for 6:30 dinner.
- Kansas City—Oct. 16, 7 p.m., Elks' Lodge. Ladies night.
- KEYSTONE—Oct. 19, 7 p.m., Castle Restaurant dinner. "Precision Gearing" speaker to be announced. Other highlights—Aircraft and Instrumental Gears.
- Кокомо—Oct. 10, 6:30 p.m., American Legion. "Story of Measurement" by a representative of DoAll Company. Color slides and booklet.

- LANSING-Oct. 18, 6 p.m., leaving Lansing by bus for trip through Kellogg Co., Battle Creek.
- LEHIGH VALLEY—Oct. 18, 8 p.m., Hotel Traylor. "Balancing" speaker to be announced.
- LIMA—Oct. 17, 6:30 p.m., Clemens Bldg. Harry Conn, chief engineer, Scully-Jones Co., to speak.
- LITTLE RHODY—Oct. 5, 7 p.m., Johnson's Hummocks Restaurant. Plant tour and buffet at the Crucible Steel warehouse in Providence.
- LONDON-ST. THOMAS—Oct. 18, dinner, 7 p.m., The Glen Allen Restaurant. "Machine Tools and the Tool Engineer" by E. W. Dickett, engineer, Sundstrand Machine Tool Co. Film "Engineered Turning Production."
- MERRIMACK VALLEY—7 p.m. dinner, 30 Putnam Rd., North Andover. "Optical Methods in Tooling" by E. M. Brockway, of Mechanical Design Dept., Bausch & Lomb Optical Co.
- MILWAUKEE—Oct. 10, 6:30 p.m., Briggs and Stratton Corp., 124th St. plant, for plant tour.
- MONADNOCK—Oct. 17, 7:15 p.m., Kingsbury Machine Tool Co. cafeteria. Plant tour of Markem Machine Co.
- Montreal—Oct. 16, 8 p.m., Bradner Room, Canadian Legion, Mountain St. "Machine Tools and the Tool Engineer" by Ed Dickett, engineer, Sundstrand Machine Tool Co. 25minute technical film.
- MUNCIE—Oct. 1, 6 p.m. social hour, 7 p.m. dinner, Empire Room, Delaware Hotel. Talk by representative of Atlantic Press Brake Co.
- Muskegon—Oct. 8, 6:30 p.m., Doo Drop Inn. "Barrel Finishing" by Frank Soper, sales engineer.
- Nebraska—Oct. 17, 7 p.m., Western Electric Co., Omaha. Plant tour immediately following regular dinner meeting.



OKLAHOMA CITY—Oct. 1, 6:30 p.m., Industrial Gasket & Packing Co., Inc., 801 S. Walker, Oklahoma City. Plant tour, followed by buffet dinner and a movie, "Accent on Accuracy."

OTTAWA VALLEY—Oct. 15, 8 p.m., The National Museum. "Machine Tools and the Tool Engineer" by E. W. Dickett, engineer, Sundstrand Machine Tool Co.

OZARK—Oct. 17, 8 p.m., Roberts Cafeteria, 6th and Joplin. "Belt Abrasives" film and discussion by J. Rice, industrial engineer, Behr-Manning Co.

Paterson—Oct. 7, 8 p.m., Brown Stone Inn, West Broadway. "New Method of Nondestructive Testing" by Mr. Struthers of Magnaflux Corp.

PHILADELPHIA—Oct. 17, 7:45 p.m., Engineers' Club of Philadelphia. Carbide N i g h t — panel discussion. Talk, "Machining High-Temperature Alloys."

PITTSBURG—Annual Educational Series Lectures, Oct. 7, 14, 21, 28, and Nov. 1. "Grinding and Grinding Wheels."

PORTLAND, ME.—Oct. 4, 7 p.m., The Falmouth Hotel. "Air Devices and Their Applications in Industry" by a representative of The Bellows Co.

PORTLAND, ORE.—Oct. 17, 6:30 p.m., social; 7, dinner; 8, technical and business, Burns Restaurant, 336 N.E. 20th Ave. "Radial Drills and Tooling" by John Hussey.

RIVERSIDE—Oct. 8, 7 p.m., Mike's Cafe. "Electrodynamics in the Field" by Stanley A. Dawkins and Robert Basore, field engineers, Consolidated Electrodynamics Corp. Two movies, "Eye to the Unknown" and "Dynamic Measurement." Discussion and question period following.

ROCHESTER—Oct. 7, 8 p.m., Rochester Institute of Technology, "What's Ahead in Manpower and Labor?" by Russell C. McCarthy, manager, Ind. Management Council of Rochester. Saginaw Valley—Oct. 17, 7 p.m., plant tour of Autolite, Bay City. "Light Metals and Plastics Manufacturing" by meeting chairman. F.I. Eldridge.

SAN DIEGO—Oct. 8, 7 p.m., The El Morocco Club, Euclid and Federal Blvds. "Modern Drills and Drilling Techniques" by Carl J. Oxford, Jr., director of research, National Twist Drill and Tool Co. Talk to be accompanied by slides.

SAN FERNANDO—Oct. 2, 8 p.m., Hody's Restaurant, North Hollywood. "Recent Research and Development on Drills and Drilling Techniques" by Carl J. Oxford, research engineer, National Twist Drill and Tool Co.

Schuylkill Valley—Oct. 8, 6:30 p.m., Walnut Room, Berkshire Hotel, Reading. "Controlled Air Power" by William Richards, vice president, The Bellows Co. Demonstration—"Bellows Little Show" and film, "Operation Pushbutton."

Southeast Kansas—Oct. 10, 6:30 p.m. George's Cafeteria. "Epoxy Resin as Applied to Tooling" by Fred Foster, general manager, Kish Resin Western Sales.

St. Louis—Oct. 3, 6:30 p.m., Kingsway Hotel. Suppliers' Night and dinner meeting.

TRI-CITIES—Oct. 9, 5:30 p.m., Collins Radio Co. of Cedar Rapids, Iowa. "The Collins Radio Company and its Position in Industry Today." Tour of the plant will start with smorgasbord at 5:45, tour at 6:45.

Twin Cities—Oct. 2, 3 p.m., Owatonna Tool Co, and Tube Co., Inc., Owatonna, Minn. Shop tours of these plants.

Windsor—Oct. 7, 7:30 p.m., Prince Edward Hotel. "Windsor Institute of Technology and ASTE" by T. C. White, director of education for Windsor. ASTE Tool Design and Die Design classes will graduate 20 men.

Worcester-Oct. 21, 6:30 p.m., Hickory House. "Use and Results of Carbide Rolls in Sendzimir Cold Strip Mill" by W. L. Chess, Waterbury Farrel Foundry Co. Joint meeting with members of the Society of Carbide Engineers.

#### **Obituaries**

Stanley C. Attwooll, Northern New Jersey, owner and plant manager, Attwooll Manufacturing.

C. L. Beisinger, Lehigh Valley charter member, planning engineer, Western Electric Company.

Clyde E. Brown, Worcester, general manager, H. C. Hook Company, Incorporated.

Philip D. Cowdin, Pontiac, in armed service.

Bhagwan Das Law, member-atlarge, technical director, Matchwel Electricals, Ltd. of India.

Thomas J. Farmer, Detroit, tool designer, Bendix Research Company.

Walter S. Gordon, Toledo, tool engineer, Lake Machine and Steel Corporation.

Walter P. Gray, Cincinnati, engineering designer, General Electric Company.

George C. Greenwood, Cleveland, general foreman, National Tube Company. W. S. Himmelsbach, Syracuse, manufacturers' agent,

Harold C. Hurtt, Cleveland, assistant to vice president of sales, National Twist Drill Company.

Frank J. Malnar, Cleveland, President, Malnar Machine & Tool Company.

Francis N. Markle, Dayton, tool designer, National Cash Register Company.

Walter McCoskey, Detroit, tool engineer and buyer, Snyder Tool and Engineering Company.

Robert A. Mulhare, Fairfield County, president, Mulhare & Boie Manufacturing Company, Incorporated.

Ray C. Oram, Chautauqua-Warren, assistant to general manager, Watson Manufacturing Company.

Howard H. Schroeder, Lima, body engineer, Superior Coach Corporation.

W. Kyle Young, Rockford, president, Metal Cutting Tools Company.

Edward B. Zellers, charter member, Lehigh Valley, planning engineer of Western Electric Company.

# If your shop does CUTTING...or BENDING...

Wallace alone makes the one machine which can both cut and deburr!

#### 3 SIZES:

A - 10" Wheel

B - 12" Wheel

C - 14" Wheel

Ask for prices. Delivery is usually from stock!



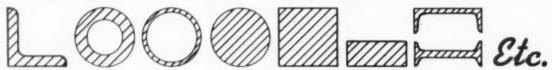
There are many jobs where even the fine burr which Wallace Cut-Machining units make cannot be accepted.

Because of this, Wallace developed the Wallace combination cutting and deburring machine. Another outgrowth of the forward thinking of Wallace engineers.

FREE: 44 page book Wallace "Cut-Machining" Units. Write for your copy — do it today!

Samples of cuts made on this machine will also be sent to you.

#### Does your shop BEND or CUT metal in these forms?



You should know what's new with the oldest maker of fine bending machinery (established 1896)

During the years since 1896 when Wallace first began to make bending machines, reinforced concrete construction became a factor in building. Wallace developed the #7 bar bender — time 1911 — since then we have made nearly 1,000 bar benders.

Today the vast majority of Re-Bar benders in service are Wallace. Again we have picked up a great deal of "know-how" about the building of high quality durable trouble-free bending machines for all kinds of industry. You can't be sure you will get the best bender for your work unless you learn what's available as a result of Wallace's 61 years of work in the bender field.

#### WALLACE #7 REINFORCE-MENT BAR BENDER.

This is a 1911 Model—some are still in use.



Our new #47 and #82 Bar Benders are the standards of Re-Bar plants.

WRITE TODAY! FREE - 34 Page personalized book on the 3 principal types of bending.

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#### NEW CONSTRUCTION TECHNIQUE DICTATES LAYOUT OF AUTOMOBILE ASSEMBLY PLANT

An assembly plant built to accommodate a new concept of automobile assembly swung into production of 1958 Lincolns and Continentals for the Ford Motor Co. last August. The operation, located in Wixom, Mich., was arranged for design capacity of 30 units an hour, on either one or two shifts. It also allows for expansion with a minimum disturbance to equipment.

The principle of unitized construction introduced at the plant permits the automobile frame to be built as an integral part of the body. Front fenders are welded to the body as part of the body build-up. Thus all body panels except the hood can be painted with the body paint equipment.

Subsequently the unitized frame, underbody, roof, body sides, front fenders and rear quarters are all welded together to form the complete body shell that is almost the length of a finished automobile.

This method of build-up, affected plant construction—length of ovens, conveyor lines and spray booths were all dictated by the length of this body shell. The different type of assembly also made it necessary to design all equipment to handle a much heavier body than before.

In layout design of the facility, there is an uninterrupted flow of material through the plant from truck dock, oil house and rail dock. To further facilitate operations, departments are located so that their heavy material requirements are adjacent to truck and rail dock. Aisleway patterns have been arranged for uninterrupted flow of material and facilities are all calculated to produce maximum number of approved units off the final line.

Qualities of corrosion and wear resistance may be incorporated into ferrous metals as a consequence of a recently developed nickel-alloy cladding process. The process, called Niphos, is easily applied to all shapes and sizes of parts. After application the coating is heated in a reducing atmosphere to provide a tightly-adhering nickel-alloy cladding which will not peel or flake when subjected to as a great as 180 deg bend.

The clad coating also can be applied locally to areas which are to be joined by brazing. The brazing operation then is completed merely by placing the coated areas in contact and heating them. Average coatings, applied primarily for corrosion protection, are about 0.001 in. thick; however, coatings up to 0.025 in. thick can be obtained in one application. Even this thickness can be increased by repeated applications to provide resurfacing or build-up of worn base metal areas.

According to engineers of Tube Reducing Corp., the Niphos coatings can prevent scaling of the base metal at temperatures as high as 1150 F.

#### MULTI-MILLION DOLLAR PROCESSING PLANT UTILIZES HYDRAULICS FOR FLOW CONTROL

Practical uses of hydraulics in processing flow control have been proved by the installation of an all-hydraulic control system for use in automatic operation of product valves by Texas Butadiene & Chemical Corp. In laying plans for the new multi-million-dollar plant, company goals were: fast operation, high output and low production costs. At the same time flexibility of control over flow of butadiene ingredients into reactors was essential.

Hydraulics provide precise and flexible control over product flow, simplify operation, afford a central power supply, and offer low initial cost and low operating cost. In such a setup only one source of power is required, reducing actual connected horsepower from about 400-500 hp, needed for electrical control of the plant, to 30 hp required by the hydraulic system.

Product gate valves are operated by small, light hydraulic cylinders, which in turn are operated by solenoid valves located at central control panels. Gate valve sizes handled by the system range from 4 to 30 in. Operating times for the gate valves were reduced to as low as one second for smaller valves to four

seconds for larger ones,

Independently operating control units were designed to control 98 gate valves involved. Each unit controls necessary gate valves for seven reactor vessels, each of which has seven gate valves.

To minimize piping and electrical wiring, there are common steel mounted panels with drilled interconnections for each gate valve circuit. All valves and filters for operating each gate valve are mounted on these panels, which are grouped for each reactor in a special cabinet.

To reduce over-all horsepower requirements and meet quick horsepower demands, the system includes a total of

# COMPACT IN DESIGN KING SIZE IN PERFORMANCE



0-M Tie-Rodless Cylinder 150 psi Air — up to 1500 psi Oil



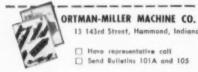
## Meets JIC Standards Fits Where Others Won't

Here's the famous O-M Original Tie-Rodless Cylinder that takes one third less installation space than conventional tie-rod type yet packs plenty of power on both air or hydraulic circuits.

The result of modern research, design and engineering know-how, this powerful O-M component figures importantly in today's automation picture. Its high operating efficiency and ease of maintenance combine with its space-saving design and rugged construction to make it highly desirable in any application where its capacity meets specifications. Ports are easily oriented to any position.

O-M Air and Hydraulic Tie-Radless Cylinders are available in a complete range of sizes (11/2" to 8" bares) with standard or heavy duty rads. Completely interchangeable parts and mounts. Immediate delivery on many sizes.

Mail coupon now for Bulletins 101A (O-M Tie-Rodless Air and Hydraulic Cylinders) and 105 (O-M Series T-H Heavy duty Hydraulic Cylinders).



Name	Position
Company	
Address	
City	Zone State

INDICATE A-10-148

ten 10-gal hydro-pneumatic accumulators. These discharge about 20 gal of oil every three minutes.

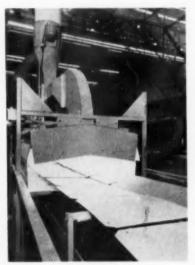
To meet a major problem of low pressure requirements to close and high pressures to open the product gate valves to avoid seat jamming, engineers connected the "close" cylinder port to a pressure reducing valve so that a reducing force is maintained when the valve is closed.

These and other valves required for the entire job make a total of more than 500. The entire system was designed and built by Rivett, Inc. and all wiring, piping and initial testing was completed at Rivett's assembly plant before shipping.

#### RADIANT OVENS SPEED BONDING JOBS

Laminate bonding with adhesives, is now achieving a recognized place among the metal joining methods of welding, riveting and fastening. The relatively new joining process is being used successfully by automotive and aircraft companies as well as other manufacturers to join dissimilar metals or to join metals to nonmetals such as glass, plastics, wood or ceramics.

Paralleling the growing use of ad-



During manufacture of dishwasher cabinets, this 22-ft radiant oven dries adhesives on steel sheet and a laminate in 1½ minutes before both sheets are placed back to back and permanently bonded with pressure by pinch roils.

hesives to solve bonding problems is the increasing use of radiant ovens to dry adhesives prior to bonding various materials into a layered "sandwich" arrangement and passing them through a pinch roll. Use of the ovens in some cases permitted the operation on an assembly line basis. In addition to aiding bonding results, the infrared drying process reduces drying time to a matter of seconds and speeds up processing and shipping operations.

Radiant oven drying in many cases provides stronger bonding of materials by preventing moisture condensation on the laminate. A special ventilating system removes solvents from the adhesive during the heating process.

Fostaria Pressed Steel Corp., a manufacturer of infrared ovens, reports three new bonding applications using adhesives plus radiant heat. One involves paper honeycomb cores that are bonded to aluminum skin to make storm doors. Another is used to bond honeycomb and other materials to outer skin of building panels, while a third involves bonding plastic laminates to desk tops and tops of dishwasher cabinets.

Honeycomb applications appear to offer possibilities for increased utility and economy because the strong, light weight material is readily adaptable for bonding to a variety of materials.

#### MACHINE TECHNIQUE PRODUCES MINUTE PARTS

Electronic insulating parts so tiny that in some cases hundreds can rest on a dime, are being precision machined from Teflon by a recently developed micro machining technique. Resultant products have tolerances as low as 0.0005 in., outside diameters as small as 0.062 in. and internal diameters of 0.012 in. One small gyro structural



Samples of micromachined fluoracarbon plastic insulators are dwarfed by a paper clip. Some of the parts have wall thickness of less than 0.008 and OD of 0.062 in.

insulating part contains a flange only 0.008 in. thick.

Although Teflon, which is a flurocarbon plastic, has high electrical insulating, heat and chemical resisting characteristics, it is extremely slippery. A relatively soft, wax like material, its machining characteristics are unlike any other material. Because of its machining characteristics, even normal size parts must be processed carefully to prevent heat distortion, fracture or buildup of stresses which might change its final dimensions.

Methods and equipment to meet the machining problems presented by this plastic were developed by Tri-Point Plastics, Inc.

#### DEVISE WELDING PROCESS PRACTICAL FOR MAGNESIUM

Using the shielded inert arc, consumable electrode process, Lite-Line Metal Industries Div. of Copperloy Corp. has devised a welding method that permits automatic, continuous welding of magnesium. Small diameter coiled wire is used both as filler metal and electrode. This process previously has been applied to other metals; however, difficulty in maintaining constant electrical contact between electrode wire and the current carrying member of the welding machine has resulted in frequent burn-backs when the process was used with magnesium. Burn-backs meant halting the operation while the welding head was repaired; consequently slower, less uniform hand type welding was preferred for magnesium.

To make the technique practical for



magnesium, Lite-Line developed a device which, under actual production conditions, will provide successful continuous welds up to 30 ft long on a variety of magnesium ranging in cross-section from ½ in, to heavy plate.

As a result, welding speeds have been increased four to six times over hand welding, and weld penetration up to three times greater than that normally obtained by hand methods has been achieved.

The process seems equally applicable to welding aluminum.

#### TECHNIQUE SPEEDS SURFACE BUFFING

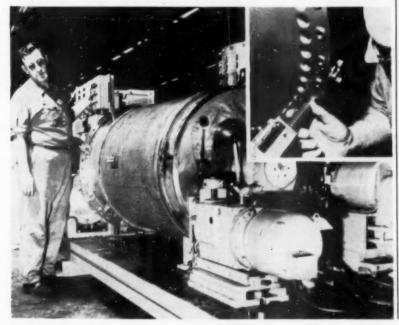
A fast method of buffing surfaces of printed circuits has been developed which leaves the sheets dry, clean and uniform. Sheets are run continuously while either one side only or both sides are buffed simultaneously at a production rate exceeding 60 sq fpm. Whether the sheet is 12 by 12 inches or 36 by 36 inches, no tooling is required.

In the manufacture of printed circuits, copper foil is cemented or laminated to an insulated sheet. Ordinarily, sometime before, during or after the operation, the copper surface develops imperfections which affect its use in etching operations.

#### EIGHTY HOLES IN ONE PART DRILLED AUTOMATICALLY

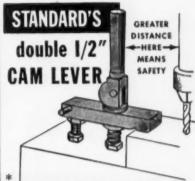
As part of a cost reduction program at General Electric's Small Aircraft Engine Dept., manufacturing engineers devised this special machine which will drill as many as 80 holes and mill 40 scallops automatically in a jet engine tailpipe. The machine can perform the

drilling and milling operations in about 30 minutes—about one-tenth of the time previously required for the same work. Engineers estimate a savings of thousands of dollars annually through use of the tool. Inset view at upper right shows close-up of drilling apparatus.



## **ČERTIFIED**

...up to 3,450 lbs. clamping force



THE JAMES H. HERRON CO., (Laboratories for Testing, Analysis and Inspection) reports as follows: "With reference to the Double Cam Lever (500) and Eye-Bolt (500), we have conducted experiments to determine the amount of clamping force a man can exert with this device, lubricated. "Without the use of any auxiliary equipment, it was found that a man could exert up to 3,450 pounds, by bringing the lever to a position 90° with the Eye-Bolt."



Finger Tip Can Tighten Clamp. Easy to Use— Positive Action

- Standard's Double Cam Lever offers maximum job clearance.
- Safe Operation—with handle vertical before clamping (as illustrated).
- Constant Maximum Clamping Pressure—perpendicular to center line of lever.
- Certified 6-Ton Back-Pressure Resistance—no danger of cam backing up.
- Ready to Use—no altering needed on assembly.
- No Lever Breakage—solid steel handle.
- This Cam can be applied to your Specially Designed Assemblies. Quotations on request.

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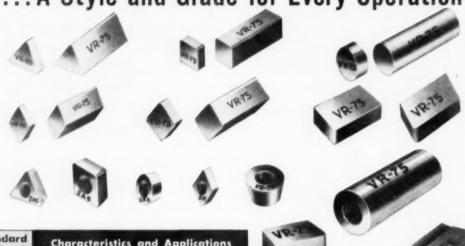
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INDICATE A-10-149

# V-R CARBIDE INSERTS

... A Style and Grade for Every Operation



Standard V-R Grade	Characteristics and Applications
EE	Strength and toughness characterize this grade. It is the strongest of all steel cutting grades. Recommended for rough and interrupted cutting.
EM	A general purpose steel cutting grade with good wear-resistant property.
VR-75	A tough heat-resistant general purpose steel cutting grade. Especially recommended for severe applications where high heat is generated.
E	A hard grade with good abrasion resistance. Recommended for medium and light machin- ing and boring of carbon and alloy steels.
ЕН	The hardest and most abrasion-resistant steel cutting grade. Recommended for high speed, light finishing cuts and precision boring.
2A5	A grade for general purpose machining of cast iron, non-ferrous metals and non-metal-lics. It has good strength and superior abrasion-resistance in excellent balance.

The hardest and most wear-resistant grade for cast iron, non-ferrous metals and non-

metallics. Recommended for light, fast fin-

ishing cuts and for machining to close tolerances such as required for precision boring.

#### Standard and Special Throw-away Type and Long Inserts for All Mechanical Toolholders

Standards. Vascoloy-Ramet manufactures and stocks a complete line of standard cemented carbide inserts for straight and lead angle turning, facing, chamfering, profiling, grooving, face milling, planing, shaping, and other operations commonly performed with mechanical toolholders.

Specials. V-R produces custom-made inserts to meet special requirements.

Let your V-R qualified field service engineer show you the economies of tooling with V-R carbide inserts. Call him today, or write.

Ask for literature.

See the latest developments in carbide tooling at our Booth No. 1615 at the Metals Show, Chicago, November 4-8.



2A7

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# TOOLS

# of today

#### Gear Motors

Integral horsepower gear motors and related transmissions are designed for compact and versatile speed reduction and require minimum maintenance. The line is available in three basic components: an integral type unit, functionally equivalent to designs where gear and drive motor are packaged into a single unit; an all-motor type which features the drive motor coupled to the gear reducer and mounted on a com-



mon carrier; and a separate helical speed reducer which may be used with a variety of prime movers.

Mounting dimensions on all three components are identical for similar rating, and parts are interchangeable, permitting maximum stock flexibility in backup parts and units.

The flexibility of mounting arrangement enables the user to cover a broad range of mounting requirements without factory alteration.

The line is offered in three basic types of speed reductions: single reduction offset shaft in speed ranges from 780 to 350 rpm; double reduction concentric shaft for speeds from 350 to 37 rpm; and triple reduction concentric shaft for output speeds from 30 to 13.5 rpm.

Integral type gear motors will be available from one to 30 hp.

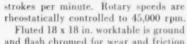
Transmission Components Dept., General Electric Co., Paterson, N. J.

T-10-1

#### Toolmaking Machine

Rotary and reciprocating motions are provided simultaneously by this Roto Recipro toolmaking machine. Because of this method of operation, the tool can be used efficiently and economically to machine contoured tungsten carbides and hardened steels. For such machining, it utilizes diamond tools, carbide files, grinding points and carbide burrs. Through the use of an interchangeable file bracket, the tool can be used for conventional tension and compression filing as well as sawing and honing.

Reciprocating motion is infinitely ad-

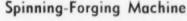


justable with a range of 85 to 500

riuted 18 x 18 in. worktable is ground and flash chromed for wear and friction resistance. Depth of throat provides machining capacity to center of 22 in. diameter with a table tilt inclinable front or back and left or right to 10 deg or in combination with graduated vernier plates.

Connecticut Tool & Engineering Co., Round Hill Rd., Fairfield, Conn.

T-10-2

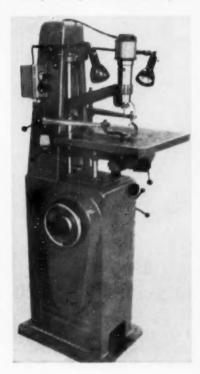


Features of a vertical spinning lathe are combined with a process for forging wall thickness of sheet parts in this machine, designated the Spin-Forge. It permits forming of parabolic, hemispherical, conical, hour-glass and other shapes from a single piece. It also provides facilities for forging the metal, to reduce wall thickness from a full inch to as little as a few thousandths.

Force used for spinning and forging is applied by two hydraulically actuated opposed rollers, that feed vertically down the form and longitudinally into die contours. Being mounted on angular-tilting heads, the rollers can follow all contours while maintaining a right angle contact with the work surface. Travel of the rollers in all directions is tracer controlled, following templates automatically. Each roller works independent of the other.

The die, contoured to shape of the finished part, is mounted on a rotating table which has spindle speeds up to 400 rpm. The entire table and spindle is carried on a slide which moves outwardly from the forming position.

Power for the spindle drive is fur-



nished by a 200 hp motor. A 225,000 lb forming force is supplied to each roll by hydraulic cylinders operating at 3000 psi. Feed rate is 60 ipm.

The system includes a closed TV circuit with two Hallamore cameras and screen for closeup vision from a remote location. Other circuits provide for programming the forming operations for automatic duplication of parts.

The Hufford Corp., 1700 E. Grand Ave., El Segundo, Calif. T-10-3

#### Tracer Lathe

This tracer lathe duplicates piece parts, from either flat or round templates, with accuracy as close as 0.0003. It is provided with push button starting for automatic cycle of carriage and spindle, and push button stop of automatic cycle which returns carriage to starting position with tool and stylus retracted.

A carriage limit switch is integral



with carriage stop is fitted to the bed. During an automatic cycle, the switch, when closed, will initiate tool relief and return carriage to start position.

Motor direction and speed are controlled by the spindle drive control levers mounted by the head stock control. A lever mounted on the pedestal provides any spindle speed from 120 to 2900 rpm.

Longitudinal feed is controlled by a lever on the control panel and actuates a pressure compensated valve regulating the carriage feed rate.

Elgin Tool Works, Inc., 1770 Berteau Ave., Chicago 13, Ill. T-10-4

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

#### Stacking Chutes

A line of stacking chutes are designed to automatically carry and stack stampings up to 20 ft away from the presses, without fear of damage to springy, small, thin, delicate or complicated stampings or to the dies.

There is no problem of backing up because of the provision of a one-way

The chutes are made from high carbon cold roll rods. Rings or plates are





FROM ORE TO FINISHED PRODUCT WITHIN THE SAME COMPANY

twist drills and scrapers. Has

technical data section

P.O. Drawer 1330, Station O

Montreal 9, P. Q.

accurately machined to maintain exact dimensions throughout the chute and are brazed to the rods so that chutes can withstand vibration shock of press operation. Maximum load capacity up to 5000 lb is assured.

Currently, there is no limit on the maximum thickness or size of stampings that can be automatically transported through the stacking chutes. Minimum thickness is approximately 0.005 in.

The chutes are mounted onto the die shoe of the press bolster and are adaptable to all types of open back inclinable presses, high production presses and dieing machines.

Clark Industries, Delaware, Ohio,

T-10-5

#### Grinding Fixture

This Grind-All fixture grinds irregular shaped perforators concentric with shank within ± 0.0002 accuracy. It can also be used for light milling and boring, radius dressing and as an inspection tool.

It utilizes a hand crank for easy rotation of index plate. A single locking



screw adjusts V-block to any position. A leatherette carrying and storage case, furnished with each Grind-All fixture, protects the precision instrument.

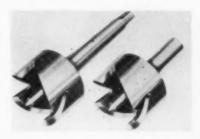
Harig Mfg. Corp., 5757 W. Howard St. Chicago 31, Ill. T-10-6

#### Boring Tool

Concentric holes with minimum burrs are produced by the Roto-Bor in sheet and plate materials to ½-in, thicknesses.

The tool utilizes four cutting lips, and is counterbored to provide high cutting speed, good cutting depth and facilitate resharpening. Available in 16, 32 and 64th-inch sizes from 13/16 to 2-1/32-in., and specifically engineered for hole cutting in thicker and tougher materials, the boring tool maintains high accuracy and efficiency on light gage metals.

Sizes from 1 to 1 9/32-in. are supplied with No. 2 Morse taper shanks, and



sizes from 1 5/16 to 2 1/32 in., No. 3 Morse taper. Both size ranges also are available with ½-in. straight shanks.

Roto-Bor is practical for ferrous or nonferrous metals, rigid plastics and hardboard. An axially retracting center point assures accurate positioning and does not require a guide bushing.

Jancy Engineering Co., Davenport. Iowa. T-10-7

#### Weld Positioner Control

Heavy-duty precision circumferential weld positioner control, designated EF-7871, is built for use with automatic fusion welding machines to permit operation of a precision welding positioner. It provides an uninterrupted circumferential weld.

Major components of the motor control are a regulated d-c motor control for positioner rotation; a ½-hp, 203 frame d-c shunt wound motor; an electric clutch-brake for rapid starting and stopping of positioner; and a tachometer calibrated in table rpm or calibrated in ipm at four table diameters. An accessory panel includes: An accessory panel includes: An acceptable tilt, electric clutch/brake control and limit switch circuitry, operator's control station, and the JIC cabinet which, with



#### 

Robbins angular tooling equipment often pays for itself the first few times you use it... but let's be conservative. Let's talk about writing off the cost over ten years. (About half the useful life of a "Magna-Sine!") Written off in this manner, the Model A-5 Magna-Sine illustrated represents an investment of around twelve cents a day!

This equipment saves dollars of valuable toolroom time on every job. Set-ups that require hours by other methods take just minutes the Robbins way. Set up to machine, grind or inspect any angle in just four simple steps: (1) Look up required angle in Table of Constants furnished with unit, (2) Select gage blocks indicated, (3) Place blocks between base and sine bar swivel block, (4) Secure the work . . . and you're ready to go!

This simple, fast, sure method sets up any angle, single or compound, right or left hand, without V-blocks, angle plates or complicated "build-ups." Complete range of models and sizes puts Robbins precision equipment within the reach of every shop. Write now for literature.



HEAVY DUTY SINE PLAT



"MAGNA-SINE" WITH MAGNETIC TABLE



FOR INSPECTION AND

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24800 PLYMOUTH ROAD DEPT. E

COMPANY DETROIT 39, MICH.

Also manufacturers of special machinery, automatic assembly machinery.

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door interlocked, has built in fused disconnect.

The table rotation is accomplished by a d-c motor geared directly to the table. Table drive system permits the table to reach its maximum speed or stop in 3 cycles.

The feedback control maintains a speed precision of ± 2.5 percent at 60 rpm of the motor shaft, and ± 0.5 percent at 1800 rpm of the motor shaft. This precision is directly proportionate, throughout the entire 30:1 ratio, with a

maximum line voltage variation of  $\pm$  10 percent.

The input to the control is 220/440 volts and 60 cycles.

Electrical controls for the positioner are enclosed in a control station which may be mounted convenient to the operator.

The compact positioner motor control designed to operate any positioner driven by a d-c shunt wound motor, mounts on the rear of the welding positioner. The main motor control panel is quick disconnect—plug connected. A remote control panel, with multipurpose control buttons, controls all operation of the positioner. Two speed-control potentiometers are provided: a reverse speed standard potentiometer, and a welding speed 10-turn micropotentiometer.

An electric clutch brake is prestarted, and then upon arc strike the clutch is operated to start the positioner. Acceleration takes place in 60 milliseconds.

The motor control provides speed regulation within 1 percent, ½ percent at base speed, response time of 30 milliseconds and a speed range of 30:1, 60 to 1800 rpm, of the motor.

Weltronic Co., 19500 W. Eight Mile Rd., Detroit 19, Mich. T-10-8

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#### Gear Grinder

No. 12 Fellows-Reishauer gear grinding machine is capable of grinding spur and helical gears up to 12 in. OD and 634 in. face width.

Pitch range is determined by the lead screw selected. Two lead screws are available, one covering from 6 to 48, and the other from 20 to 120 dp.

The gear tooth shape is generated by





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an emery wheel on which a helix has been developed. The tooth section of the wheel is usually that of the basic involute rack. There is no mechanical connection between the wheel spindle and the work spindle; these are driven by synchronous motors. Grinding is done in both directions of travel of the work slide. Machine setup is simple and fast, making the tool practical for grinding of single piece lots as well as long production runs.

The Fellows Gear Shaper Co., Springfield, Vt. T-10-9

#### Boring Head

This boring head, called the Deka-Bore, does both rough and finish boring in one operation. Because of the rigid construction the roughing tool in the front of the quill will remove stock from a cast hole, and the finishing tool will follow behind and finish the hole, holding a tolerance of 0.0003 in. The



Deka-Dial permits simple, rapid, accurate adjustments to 0.0001 in. on diam, without backlash,

The patented Deka-Bore movement is a radial adjustment so proper clearance on the toolbit can be maintained at all times. The tool is especially adaptable to boring in close quarters, because it can be made as short as 1½ in.

Precision Tool Mfg. Co., Inc., 1305 S. Laramie, Cicero, Ill. T-10-10

#### Tracer Lathe

The Masterline center drive tracing lathe is designed to permit simultaneous machining of both sides of jet engine and turbine disks. With a capacity for 28 in. diameter disks, it will perform heavy duty rough machining operations on either stainless steel or titanium. It also produces to the extreme accuracies required in finish machining of the disks. The machine uses a four-pass Gisholt JeTracer on each side, with templates governing movements of the tools for roughing and a separate template and new tool indexed into position for the



#### IBM AUTOMATES WITH POWRLOCK!

In the International Business Machine Corp., Endicott, R. Y. plant, PowRlock air hydraulic setup clamps have been used to automate this milling fixture. A touch of the control now opens and closes the same fixture which previously was tightened and loseened by using a socket wrench on two manual clamps. The results are much faster loading, less operator fatigue, and elimination of waste labor. PowRlock setup clamps are the first step to inexpensive automation. They install easily on most existing fixtures, lock instantly at 1 to 16 different locations, and completely eliminate manual clamping. Find out how they can make men and machines more productive in your plant!



Attach this ad to your letterhead for free demonstration or literature!

#### WILTON TOOL MFG. CO., INC.

DEPT. TE-10, SCHILLER PARK, ILLINOIS

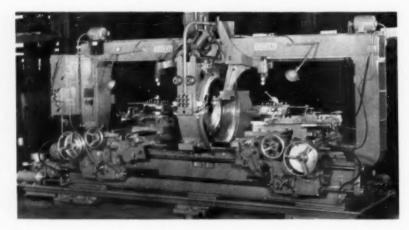
Wilton Vises Are So'd By Loading Distributors Everywhere

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finish cut. This arrangement offers accuracy in reproduction of required contours and a fine finish through an adjustable speed drive controlled by movement of the tracer cross slide.

Basically the lathe consists of a bed with a center driving unit and overhead support. Bedways, extending to the left and to the right of the center driving unit, support a left and a right-hand independent side carriage, each with a bridge-type cross slide with 34 in. of cross movement, a JeTracer slide and a four-position turret type tool post. Each cross slide has a four-position indexing drum to carry necessary tracer templates, permitting a maximum of four different passes over the work. Each side carriage has 24 in. longitudinal movement. Rapid traverse is provided for each carriage in the longitudinal direction and for each cross slide in the



transverse direction. A complete pressure lubrication system is provided for all moving parts of each carriage.

The machine has provision for reversing direction of spindle rotation when the tracer controlled tools reach mid-points on the disks. This permits machining from behind the centerline and across center from the ID to the OD.

There are longitudinal feed dials for both carriages, tool setting gages on the center drive housing, adjustable lights to help in tool setting. 8-power microscopes mounted on the center drive housing for accurate tool setting and dial indicators and stop rod arrangements to speed longitudinal and transverse positioning of the tools, cross slides and carriages.

During experimental work with this lathe on 28 in, diameter compressor disks an accuracy in the center bore and the snap ring diameters of less than 0.001 in, was held. Disks have been machined, under production conditions down to 0.080 in, web thickness. Parallelism with the bore, OD, and the two faces of the work is 0.0008 in, on the 14 in, radius.

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis. T-10-11

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#### Machine Control

Machines can work unattended when they are operated by TorqueTrol automation device. In addition to controlling tool feed, the tool detects jamming, tool wear, faulty lubrication, etc., and either stops the machine or sounds an alarm.

Connected to a recorder, it registers length of time the tool has been used, indicates when machine performed work, when it idled. Connected to a counter, it counts machine's work strokes.

It can also detect when a pump is "gummed up" or overloaded; will control rhythm of step drilling and start the chip clearing cycle, or tell when the capacity of a conveyor is reached



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-156

and warns of excessive die pressure on a press.

Any abnormal condition in the machine operation increases the torque and the load on the motor shaft. This causes an increase in the power used by the motor. TorqueTrol which responds to power rather than current, monitors the electric power, detects this increase, and stops the machine in milliseconds.

Electronic Control Corp., 1573 E. Forest Ave., Detroit 7, Mich. T-10-12

#### Tool Life Appraisal Device

This time-saving appraisal device is designed to permit buyers to anticipate length of tool life from new equipment before making investments. The wheel is based on a commonly used formula but speeds up calculation. It also can



be used by designers for making a choice between designs evaluating elements of a single design.

Only 6 in. in diameter, the Appraisor scales are clear and cover a wide range of figures. It is made of vinyl plastic.

Van D. Mark, P. O. Box 67, Mount Clemens, Mich. T-10-13

#### Ball Bearing Groove Gage

Designed to make simultaneous checks of four dimensions of ball bearing outer races, this gage checks diameter by means of expanding jaws which home on the surfaces involved and operate suitable standard gaging capsules. The movable jaws are reed mounted and actuated by air cylinders. The three ball groove jaws also act to establish the groove center so that the groove center-to-face check can be made.

Three groove diameter circuits actuate signal lights. Lights are omitted in the groove-to-face circuit since the customer desires to check the groove in relation to both faces to determine centrality.

Radial position of all jaws is adjust-

# These Oakite shortcuts speed your metal cleaning

#### 1. Cleaning and rustproofing

-in one washing operation.

Oakite Composition No. 98 (used cold or hot in one-stage or two-stage washing machines) quickly removes cutting oils and chips and leaves a thin film that protects steel against rusting between operations or during temporary storage.

Excellent for cleaning before inspection: the metal is cool for immediate handling and the film (too thin to affect measurements) prevents finger prints from corroding highly finished surfaces.

One auto manufacturer uses No. 98 in seven plants for cleaning and rustproofing brake cylinders, camshafts, connecting rods, crankshafts, cylinder heads, flywheels, push rods, tappets, wrist pins, etc.



#### 2. Stripping pigmented paints—with no need for pickling before repainting.

Oakite Rustripper saves money in paint shops by doing a complete stripping job in one operation. It eliminates extra pickling and neutralizing to remove the metallic pigments, phosphate coatings and rust that prevent successful repainting.

A television manufacturer says "We formerly took 25 minutes to strip rejected cabinets, then had to pickle to remove tarnished phosphate coatings. Today 10 minutes in Rustripper strips the same cabinet so bright and clean you can't tell it from new. Eliminates pickle, neutralize and rinses."

An auto parts maker uses Rustripper for continuous conveyor line stripping, "Cycle of 1 minute and 50 seconds works like a charm stripping paint and incidental rust from rejects and hooks,"



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Export Division Cable Address Oakite



able; this, in conjunction with quick change gaging contacts, makes the gage adjustable over a groove diameter range of 0.714 to 2.784.

All movable jaws are simultaneously retracted for loading by means of a foot-operated valve. Gaging contacts can be rotated a few degrees in their respective sockets so that an unworn portion of their surface is presented to

Moore Products Co., H & Lycoming Sts., Philadelphia 24, Pa. T-10-14

#### Copy Grinding Machine

Designed for simultaneous grinding of two flat or circular form tools with a maximum width of 2 in., this copy grinding machine is equipped with an



attachment which enables a vertical or lateral undercut of 90 deg walls.

Main important advantage of this machine, called the Copyrex, is its speed. One pair of flat form tools 3/4 in, square can be both rough and finish ground within 10 to 15 min.

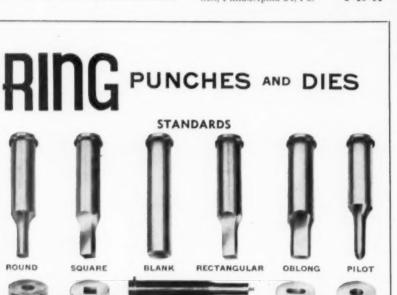
F. Bläsi & Co., à partir ler 12.56 Blasi S. A., Soleure, Switzerland. T-10-15

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#### Program Controller

This sequence control, called Sequentrol, provides a vernier dial or revolution counter type control that is set on the panel for each position or rate that is to be established. In programmed sequence, each dial or counter assumes command of the setting of the gear motor operator. The shaft-mounted gear motor, called a Shaftrol, establishes position of a tool, setting of an adjustable speed drive, or valve, or the location of an assembly table or indexing device. Because this gear motor is designed to mount in place of handwheels or control cranks, the combination unit may be used to convert machines now operated manually to automatic se-

Built-in adjustments in the sequence control unit signal the Shaftrol to slow down as the desired setting is approached, to avoid overtravel and hunting. It is designed to handle operators from subfractional to 10 hp. The gear motor is available in explosionproof or standard enclosure, and the sequence



COMPLETELY INTERCHANGEABLE SHIPMENTS FROM STOCK CHOICE OF STEELS HIGH QUALITY LONG LIFE LOW COST PUNCH & DIE RETAINERS Tough alloy retainers accurately machined for Ring Punches and Dies. Ease of mounting saves time and SPECIALS

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Send prints or sketches for quotation on your requirements. Prompt

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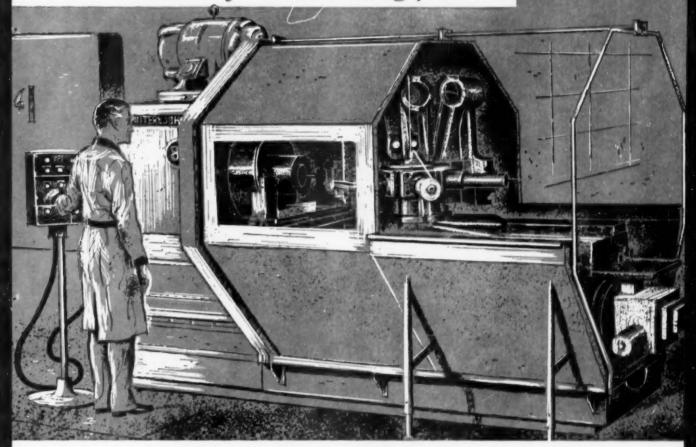
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Here it is . . . . the machine industry's been asking for !\*



# THE NEW P&J 8-U

**AUTOMATIC** Turret Lathe

\*A MACHINE TO FILL THE GAP BETWEEN OUR 6 DREL-40 AND 10-U

Here is a new automatic with the extra power, rigidity and capacity you may be looking for. It's designed and engineered to handle your really big, hard-to-machine jobs faster, better and more economically than ever before. It will hog out tough alloys in a hurry, hold close tolerances and produce fine finishes with speed and efficiency. The 8-U with 50 hp, 30" chuck and 40" swing is intermediate in size between our 6 DREL-40 and 10-U. Take a minute now to write for specification circular and see how the new P&J 8-U fits into your production schedules.

Potter & Johnston Company, Pawtucket, Rhode Island.



AUTOMATIC TURRET LATHER



GEAR CUTTERS



GILDA PACKAGING MACHINES



**POTTER & JOHNSTON** 

SUBSIDIARY OF PRATE & WHITNEY COMPANY, INC.
PRECISION PRODUCTION TOOLING SINCE 1898



control is available in an explosionproof housing. Sequentrol commands may originate from controls set at the panel as shown, from remotely located potentiometers, or from punch card reading devices. Reset accuracies of ½ of I percent of full scale are standard and higher accuracies are available in special models.

The Jordan Co., Inc., 3235 W. Hampton Ave., Milwaukee 9, Wis. T-10-16

#### **Dividing Attachment**

Designed to fit all models of Universal's rotary tables, this dividing attachment permits divisions from 2 to 63 in-



clusive and 27 additional divisions to 100. Other divisions are obtainable by formula

Universal Vise & Tool Co., Parma, Mich. T-10-17

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#### Contact Gages

These Go and Not Go electric limit contact gages utilize a signal light attachment to report accurately within 20 millionths of an inch over and undersize as well as correct size by flashing green, red or yellow lights. A socket for a control connection permits further automation.

The electric comparators come with dial or without dial. The dial type permits observation of the position relative to tolerance limits on the dial in addition to the action of the signal lights.

Automatic controlling devices may be

attached to the second socket of the signal light box. For example, an acoustic signal may be sounded, whereby blind persons may be employed as inspectors. Changes in dimensions beyond tolerance limits may be announced acoustically in comparators checking running work which are not observed continuously.

Small parts may be segregated according to gaging results through switches controlled by the electric limit contacts, and the work guided into various sorting channels. By installing auxiliary relays in the control circuit, it is possible to use heavier devices with a larger electric load, such as one that stops a machine whenever the work is gaged off-size by the comparator.

George Scherr Co., Inc., 200 Lafayette St., New York 12, N. Y. T-10-18

#### Portable Broach

This portable broaching machine, designated Porto-Broach, utilizes a hand held gun type broach puller.

Models PM2509 and PM5009, which provide accurate method of broaching on the assembly line, produce round holes 3/16 to 1½ in. in diameter, as well as other shapes in perfect align-



ment holding tolerances as close as  $\pm 0.0002$  in. Stock removal up to 1/32 in. in  $2\frac{1}{2}$  in. length of cut can be broached in a single pass.

Assemblies may be broached in position, on a high production basis without the use of fixtures or bushings. There is no need for handling and mounting the workpiece onto the machine.

Both Models PM2509 and PM5009

PRATT & WHITNEY
PRECISION
ROTARY TABLES



PLAIN . . . in 12" to 50"

12" and 20" diameter hand-operated and 24", 30", 42" and 50" diameter motor driven models. Also available in 42" tables with automatic indexing or with P&W Numerical Control.



TILTING . . . in 10" to 36"
10" and 16" diameter hand-operated
and 24" and 36" diameter
power-rotated models.



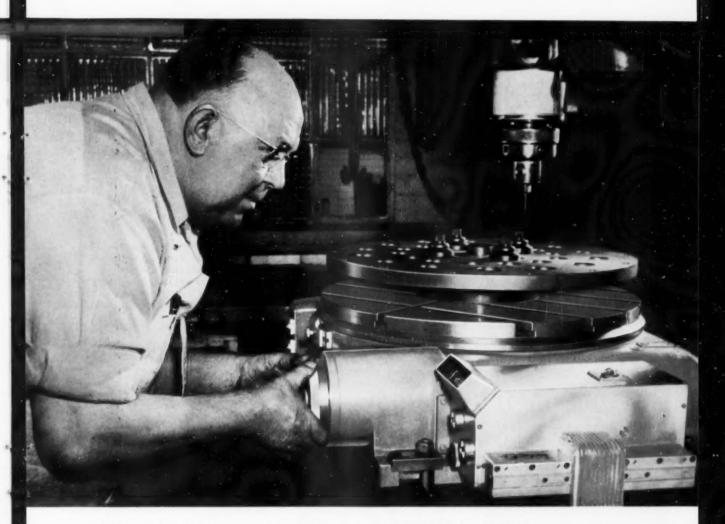
VERTICAL . . . in 30" and 48"
diameters, motor-driven.



PRATT & WHITNEY

INDICATE-A-10-160

The Tool Engineer



# Here's how one company IMPROVED PRODUCT PRECISION and PERFORMANCE

#### WITH A PRATT & WHITNEY OPTICAL ROTARY TABLE

The high-precision special machines manufactured by the Bodine Corporation of Bridgeport, Connecticut are used throughout the mass-producing industries to process small parts. The heart of every Bodine machine is the "dial" which requires from 20 to 200 accurately bored holes arranged in from 10 to 36 stations. To improve the precision of this critical component, the Bodine Corporation recently purchased a new Pratt & Whitney 24" Optical Rotary Table. As a result, tolerance between stations on the dial has been cut from 15 seconds of arc down to just 3 seconds and, as a spokesman for Bodine Corporation has stated, "... the improved efficiency of our product is obvious!" In addition to this table's greater

accuracy, Bodine also likes the easy-to-read optical screen that cuts down on operator fatigue and the fact that constant use produces absolutely no error from wear.

If any of your own machining, inspecting or calibrating operations require extremely accurate circular spacing or angular positioning, it is more than likely that a Pratt & Whitney Optical Rotary Table can help you improve your product's precision and performance.

Write now for complete information. Pratt & Whitney Company, Incorporated 16 Charter Oak Boulevard, West Hartford, Conn.













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MACHINE TOOLS . GAGES . CUTTING TOOLS

are caster-mounted in cabinets 12½ x 15½ x 25 in. for on-the-job use. They are powered by a self-contained hydraulic power unit using a 110/220-volt a-c main motor. The unit may be used for conventional internal pull broaching when the gun is mounted on the side of the cabinet.

Model PM2509 develops 5000-lb pulling capacity with a 9½-in. stroke and was designed for broaches of 3/16 through 5% in. diameter. Model PM5009 develops 10,000-lb pulling capacity with a 9½-in. stroke, and will accommodate broaches of ¾ through 1½ in. diameter.

Engineering Dept., Pioneer Broach Co., 6434 E. Telegraph Rd., Los Angeles 22, Calif. T-10-19

#### Splining Attachment

This splining attachment for the Morrison 1-in. Keyseater consists of a master jig bored plate, taper pinned in two places and bolted to the table top. Through the two taper pins, the attachment can be relocated accurately.

Work is held in a rotary fixture which indexes any number of splines or keyways. An automatic device centers the work quickly; it can be set for multiple jobs and will automatically center the next workpiece.

Among automatic features of the tool are the feeds of 0.002, 0.004 or 0.006 in.; automatic relief which causes the table to back away 0.040 in. on the up



stroke; and automatic stop that cuts off the feed for any given depth.

Stroke is adjustable from 6 to 9 in. No bushings are used with the attachment. The cutter bar is supported close to the actual cut by a quick act-

ing, adjustable support.

The D. C. Morrison Co., P. O. Box 1017-K, Cincinnati 1, Ohio.

T-10-20

#### Punch Clamp

These mechanical punch clamps make it possible to mount punch dies to press slides quickly.

They can be permanently mounted to the slide flange of a press. A pivot base is mounted to the top of the slide flange so that it removes all tensile loading from the mounting screws. A swinging T-bolt, which fits through an open slot in the slide flange to a pocket on the die, is threaded at the top and



keyed to a bevel gear. The mating pinion gear is turned by simply inserting and rotating a wheel wrench. To prevent accidental loosening, a springloaded locking pawl drops into position as the removable wheel wrench is withdrawn from the gear's socket. A beveled collar on the wheel wrench shaft slips under and raises the pawl from the locked position when inserted.

The punch clamps are available in two sizes, with 10 and 15-ton capacities. Total capacity of the punch clamps is considered equal to 10 percent of the press capacity. They may be installed on virtually any press. Minimum ma-



chining is required for proper installation. Die can easily be made or adapted with T bolt pockets to correspond with the punch clamp spacing on the slide.

Clearing Machine Corp., Div. of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill. **T-10-21** 

#### Molten Metal Pump

This small vertical centrifugal gusher pump, Model 9025-M, is built for handling molten metals, such as solder, tin, zinc, lead, etc. at temperatures up to 700 F.

Safe operating temperature of the motor is maintained by utilizing three aluminum cooling fans, which rotate simultaneously with the heavy one-piece



extended stainless steel shaft. Two ball bearings, packed with high temperature silicone grease, are confined within the motor to eliminate the necessity for bearings or metal contacts in the high temperature area.

The unit is available with either ¼ hp, 1140 rpm or ¾ hp, 1725 rpm Class B insulated motor, for capacities up to 7 gpm and heads up to 8 ft.

The Ruthman Machinery Co., Cincinnati 2, Ohio. T-10-22

#### Marking Machine

High-speed, Model 482 automatic Dual-Dial machine, designed for marking thin wall cup shaped parts or tubes, roll marks permanent indents of part numbers into each workpiece at a production rate in excess of 5,000 pieces per hour.

The machine has two counter-rotating dials, driven by a single 1/3 hp motor, mounted in the column of the machine. The motor, equipped with an adjustable pitch sheave, is mounted on an adjustable bracket, which is operated by a hand wheel at the side of the machine to provide infinitely adjustable speed.

The work feed dial carries workpieces to a reciprocating feed finger, which transfers each part onto a work mandrel

#### NEW TORIT DIAMOND DUST COLLECTOR SAVES YOU UP TO 30% OF CARAT USAGE; COSTS ONLY \$178.50!



exclusive new centrifugal design simplifies recovery, serves all diamond grinding operations

Actually pays for itself in days. In an on-the-job test of this new TORIT equipment, the initial investment was returned in just 21 operating days. The test was conducted by a leading automobile manufacturer under regular operating conditions. Recovery averaged 30% of the carats originally contained in the diamond grinding wheels. You actually get a cash return of \$1.00 for every \$10.00 invested in diamond grinding wheels.

For all diamond grinding operations. This new TORIT Collector provides the same outstanding performance in all types of grinding operations—mist, wick or dry. Its design and operational simplicity also mean virtually maintenance-free service. Its tough construction assures long, long life.

Installs anywhere. TORIT'S new Diamond Dust Collector can be used alone or in conjunction with central exhaust systems or unit dust collectors. It weighs only 65 lbs. and requires only 14" x 22" floor space. Its centrifugal separating action uses no filters or sloppy, inflammable oil baths. Service is quickly and conveniently performed by simply unscrewing the unit's top for removal and emptying of the clear plastic container.

FREE details and full specifications on request. Here's your chance to really save on your diamond usage. Write today for full information on this important new diamond grinding development.

TORIT MANUFACTURING COMPANY Walnut & Exchange Sts., St. Paul, Minnesota

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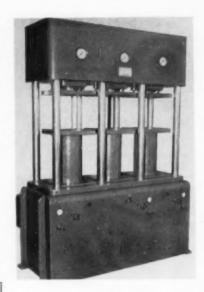
on the 12-station work dial. Parts rotate on the work mandrels as they travel across the face of the marking die and are ultimately ejected automatically at the rear of the machine.

The machine is equipped with an emergency stop button and a safety switch which stops the machine immediately should a workpiece not be properly seated on the mandrel.

The Noble & Westbrook Mfg. Co., East Hartford, Conn. T-10-23

#### Multiple Hydraulic Presses

Multiple hydraulic presses, which use a single operator, are available in single, double, triple or quadruple units. Multiple stations provide for staggered



Precision Built for...
HIGH SPEED PRODUCTION TAPPING

WISCONSIN

Lead Screw Tapping Units and Tapping Heads

> Model L.A. 2-Spindle Tapping Head

Lead Screw
Tapping Unit
This unit is regularly furnished with a flanged quill and slotted spindle for close coupled, multiple spindle, precision tapping, it can be furnished without the quill flange, and with an A.S.A. 1"

dia. adjustable adapter for a No. 1, 2

Model TU-415 Automatic

W ISCONSIN builds Adjustable and Fixed Spindle Drill Heads and Tapping Heads, Lead Screw Tapping Units, Special Machines, Fixtures, Fixture Bases and Index Tables.

Write for Illustrated Literature

or 3 Morse taper.



WISCONSIN DRILL HEAD CO.

4985 N. 124th St., Butler, Wisconsin

FOR FURTHER INFORMATION, USE READER SERVICE CARD, INDICATE A-10-164

A7-9187

curing cycles. Each section of the presses, which take their power from the shop airline to mold rubber, plastic or ceramic, has a capacity of 50 tons. Platens are 13 x 13 in. Maximum operation for each section is 5,000 psi. Temperature range is 150 to 550 F, and they are available with or without heated platens. Ramstrokes and daylight openings are 13 in.

A single unit houses all controls. Installation cost is minimized since each press is a self-contained unit and there are no pumps nor motors to add.

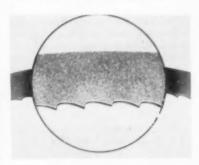
Various modifications are offered, such as pressures up to 250 tons, several sizes of ram diameter, water cooled platens, higher temperature ranges, etc.

Allied Engineering and Production Corp., 2421 Blanding Ave., Alameda, Calif. T-10-24

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

#### Band Saw

Continuous cutting high-speed steel band saw, called the Safe-Flex, offers extremely hard teeth for cutting at maximum speeds and feeds combined with a back that has flexibility and



extra toughness for safety and long life.

This high-speed steel band will retain hardness even up to temperatures of 1100 F. Thicknesses of these bands range from 0.025 to 0.042 in.

They are available in regular, hooktooth and skip-tooth types in four widths and a wide variety of pitches. They are suitable for cutting tool and die steels, all ferrous alloys including carbon, free machining, alloy, tool and stainless steels, as well as titanium and other hard-to-cut-metals.

The L. S. Starrett Co., Athol, Mass. T-10-25



operation, can be used to pull the fastener through the hole and bring the faring surfaces into positive contact with one another. The operator then

actuates a switch on the gun for selection of full working pressure which is used to actually set the fastener with design tensile preload, swage the locking collar in place and break off the fastener pintail.

Built to JIC standards, the unit consists basically of electric drive motor, hydraulic pump, filter, cooling system and two separate system relief valves, one for low pressure and one for high pressure operation. The low pressure circuit is adjustable between 600 and 1800 psi in the standard design. The high pressure relief valve setting is

#### Air Control Valve

Designed to seal all critical parts from dirt and abrasives, thus increasing valve life, these Flo-Pilot valves have a small synthetic rubber boot which snaps in place around the valve stem. Aluminum stainless steel and molded nylon are used extensively to provide resistance to corresion.

The basic valve has five optional actuating heads-palm button, ball cam, lever, locking lever, and mechanical link



clevis. These are interchangeable in less than 30 seconds without danger of disturbing the piping. Any of these valves can be base, panel or wall mounted. The same valve can be used as either a two-way or three-way valve. Either valve can be normally open or normally closed to inlet pressure, depending on the piping arrangement. The valve is built for 150 psi air operation and has 1/4 in, pipe ports.

Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill. T-10-26

#### **Driving Equipment**

Portable, two-pressure electrohydraulic power cell, designated Series 700, permits installation of Huckbolt fasteners with maximum interference fit. The new unit is used with Model 607 hydraulic tool, designed for doubledriving application of commercial or aircraft Huckbolt fasteners up to 1/2-in.

The tool, set initially for low pressure

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CORPORATION

Engineering and Sales Representatives in the Principal Cities FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-165

fixed at 3000 psi to provide the necessary high working pressure.

The power cell, which has an aircooled hydraulic system of 6-qt oil capacity, is available in three models equipped, respectively, to accept 110, 220 or 440-v electrical input power. The 440-v model is equipped with a transformer to convert the power supply to 110-v current.

The drive motor is a constant speed a-c type nominally rated at 11/2 hp. It is available as either a 110-115 v 60cycle or 220-v 60-cycle, single phase type. The cooling system is designed to maintain a temperature differential of 16 F oil temperature over room temperature.

Huck Mfg. Co., 2480 Bellevue Ave., Detroit 7, Mich. T-10-27

#### Injection Molding Machine

These 1/2 to 1-oz capacity plastic injection molding machines, with simple, low-cost, parting-line sprued molds, will mold all thermoplastics. They provide up to 30,000 psi (hydraulic) pressure.

Push-button controls are fast, positive in action, and marked for visual or touch recognition. No special knowledge or skill needed to operate the units.

The "air-Jet" models are air powered and suitable for quick-development and production of small plastic molded experimental and short-to-moderate run items, particularly those containing metal inserts.

Due mainly to its simple V-type mold



with interchangeable cavity-cell, this Mini-Jector air-Jet unit is useful for producing complex designs. After each cycle, the mold block ejects automatically for removal of molded item, and quick, easy placing of metal inserts. Colors are changed without loss of time. Simple interchange of cylinderram-heater box assemblies offer 1/3 to l oz capacity selectivity.

Newbury Industries, Inc., Newbury, T-10-28

#### Turret Punch Press

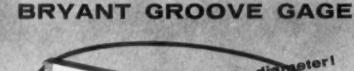
This four-ton 12-station, hand operated Di-Acro turret punch press will pierce and blank holes from 1/16 to 2 in. in sheet material.

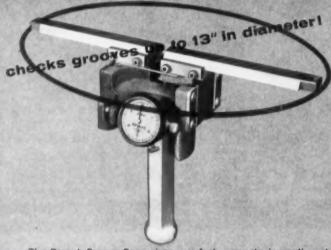
Designed for use in model shops and for short run production, the press has micrometer type back and side gages,











The Bryant Groove Gage gives you fast, accurate inspection at low cost. With long segments, as shown, you can measure grooves up to 13" in diameter.

The standard Bryant Groove Gage kit includes four pairs of segments to check "O" ring grooves through 5" dia. and four pairs of

segments to check snap ring grooves through 5" dia. Immediate delivery from

Also available: Bryant bench gages to measure internal threads, external threads, concentricity and squareness of face, and portable gages for checking internal threads. Write for complete information.



P. O. BOX 620-J. SPRINGFIELD, VERMONT

Division of Bryant Chucking Grinder Company FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-166 called Micro Twin, that can be set at any point from maximum adjustment to the center of the smallest punch in 60 seconds.

Clearance as small as 0.002 in. is offered on the punches and dies used. and holes can be punched in thin sheet material without distortion or burr. Stripper plates are provided as standard equipment for each of the 12 stations.

Round, square, oval, rectangular and notching punches and dies are available for use with the machine. Choice of six different clearances are available in the punch and die sets.

In addition to punching sheet metal, the Die-Acro turret punch press can be used with such material as fiberboard, masonite, asbestos, gasket material, paper, cork, leather, rubber, plastics. screen and mesh and other special

Four-ton capacity of the machine enables a 2 in. hole to be punched in 16 ga mild sheet steel, a 1/4 in. hole in 3/16 in. steel plate. Depth of throat is 12 in., over-all height is 25 in., width 30 in., and depth 20 in.

O'Neil-Irwin Mfg. Co., 625 Eighth Ave., Lake City, Minn. T-10-29

#### Boom Truck

This industrial truck, called the Hydro Boom permits the operator to control boom movement hydraulically. Work loads are positioned by telescopic action to within 1/100 of an inch, in both



vertical and longitudinal directions. Cross-wise movement is easily directed by a hand operated screw in a close fitting swivel block.

There is no straddling of work loads. Vertical, longitudinal and cross-wise movement of boom is possible under full load. Boom movement is precisely controlled.

Boom reaches up to 48 in. beyond the front end of the truck. Capacity is 1500

#### **Automatic feeding** and setting with...



#### Speeds up riveting and clinching!

It's a quick step to faster assembly and reduced labor costs when you put T-J Rivitors and Clinchors in your production picture! These performance-proved machines are suited to a wide range of assembly jobs for aircraft, automotive, farm machinery, riviting jobs of all kinds.

T-J RIVITORS automatically feed and set solid rivets with high production. Electrically powered Rivitor sets solid steel rivets up to 7/8" long. Throat depths 8" to 36".

T-J CLINCHORS set clinch nuts with fully automatic operation, controlled by a single foot pedal. Available in Underfeed and Gravity feed models, throat depths 8" to 36".

Send today for these helpful references: Rivitor bulletins 646 and 555 . . . Clinchor bulletin 555. The Tomkins-Johnson Co., Jackson, Mich.









#### Effective Quality Control Through Accurate Hardness Tests

Solve quality control problems with the King Portable Brinell Hardness Tester. Take faster, more accurate hardness tests on odd-shaped metal parts without elaborate fixturing or cutting samples. The King Portable uses a 3000 kg. load on a 10 mm. ball with automatic relief. Intermediate loads as desired. Weighs less than 30 lb. and takes guaranteed accurate tests anywhere. King Testers are the standard of dependability in portable hardness testing equipment around the world. Write for details and specifications.

#### KING TESTER CORPORATION

Dept. T. 440 North 13th St., Philadelphia 23, Pa.

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lb at maximum boom extension, or 2500 lb with boom retracted.

The Hydro-Boom is available in hand operated or battery powered models with or without power propulsion.

Vanguard Engineering Co., 1908 E. 66th St., Cleveland 3, Ohio. T-10-30

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#### Drill and Countersink Extension

This replaceable, stub taper combined drill and countersink extension is particularly suitable for vertical and horizontal boring mills, jig bores, and drill presses. It may be used in conjunction with fixtures utilizing bushings to guide adaptors for spotting holes and centering parts.

Center drill sizes are 1/8 through 5/8



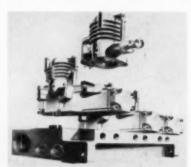
in, diameter, and adaptor lengths are  $3\frac{1}{2}$  through  $7\frac{1}{2}$  in., in standard one inch increments.

Other features are hardened and ground OD; ground tapered hole for locking drive and knock out hole for replacement.

Unidapt Co., 945 E. 10 Mile Rd., Hazel Park, Mich. T-10-31

#### Control Valve

Line of Speed King plug-in type 1/4-in. 4-way control valves have plug-in connectors built into pilot, valve body and manifold or subbase which complete electrical connections as components are bolted in place. Fixed connections to the machine's circuits, made in the manifold or subbase at the time of original assembly, need not be disturbed. Available in both single and double solenoid types, for manifold or



subbase mounting, the valves minimize installation and in-service maintenance time

Designed for control of smaller devices, the valves are compact in size, provide extremely fast operating response, and multimillion cycle depend-

Valvair Corp., 454 Morgan Ave., Ak-

#### Magnetic Clutches

Style GS and GSW stationary electromagnetic clutches for dry and wet applications respectively are easy to install, fast acting, offer simple positive adjustment and have low maintenance requirements. Adjustment to compensate for lining wear is simple. The same adjusting screws that correct for lining wear also provide a means for mechanically engaging the clutch in event of a power failure.

The clutches provide smooth engagement and disengagement and can be



actuated remote or direct with automatic or manual controls. Direct magnetic action avoids use of mechanical yokes or shifters. Because of plug-in electrical connections, there is no need for slip rings or brushes.

These clutches can be easily adapted to modern machine tools and are available in sizes from 4 to 9 in. in diameter.

Stearns Electric Corp., 120 N. Broadway, Milwaukee 2, Wis.

#### Drill Grinder

Model SM-3 drill grinding machine, for drills 0.012 to 0.120 in., is designed to permit unskilled operators to use it efficiently. The drill is simply clamped into holder, which accommodates the machine's complete diameter range, and is checked under microscope. Special shape of the holder assures symmetrical sharpenings of either right or left hand drills regardless of the predetermined tip angle or backing off angle. A wheel truing attachment, built into the machine, is operated by simply controlling the oscillation motion of the

Weighing only 55 lb, the SM-3 has

Write for

catalog

5257 W. ARMSTRONG AVENUE



a 3 phase, 220 v, 6 cycle motor. Microscope grinding wheel, built-in truing attachment with diamond, one drill holder lighting fixture, tweezer and wrench are furnished with the unit.

Jersey Mfg., Co., 455 Livingston St., Elizabeth, N. J. T-10-34

#### Drilling-Tapping Machine

This multispindle drilling and tapping machine, arranged for rapid adjustment of the spindles, is suitable for short runs of work or long continuous operations. The spindles can be fixed in any position either in circles, straight lines or irregularly, and can operate at different speed ranges. Automatic depth gages are provided and an electrically controlled device governs the operation. Tapping operations may be done with different pitches, and the ac-



nished in two styles and three sizes. Complete tools is given in Bulletin CIT, mailed on request.

ARMSTRONG BROS. TOOL CO. The Tool Holder People

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CHICAGO 30, ILL.



curacy of the reverse rotation of spindles enables the tapping of dead holes, to close tolerance. Gears and universal joints of this Starrett machine operate in a continuous oil bath. Feed, with four normal and four rapid speeds, is automatic.

Distributed by Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y. T-9-55

#### Time Cards

A method of automatically computing elapsed time and cost on time cards without the use of machines or mechanical gadgets is possible with these specially designed time cards.

Preprinted scales are incorporated on the card used by employees in marking the time for each job. A line is drawn through the starting and stopping times of each job.

When cards are received in payroll department they are placed over a master chart on which all computations have been made by the various rates applying in the shop.

Design is such that when the line through the starting time for a job is placed at top of the master chart, elapsed time and amount of money is automatically indicated opposite the "stop" line.

These charts and scales are available in 6 minute and 15 minute intervals.

Lybeck Business Systems, 28 LaBelle St., Highland Park 3, Mich. T-10-35A

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#### Blast Cleaning Table

A 4-ft Rotoblast table room is a small, flexible machine which will economically blast castings, forgings and stampings up to 48-in. diam by 24 in. high, as well as plastic and composition materials.

Capable of blast cleaning loads weighing up to 4000 lb, this table is equipped with a cast labyrinth abrasive sealing system which makes the cabinet abrasive tight without rubber gaskets. For loading, a single door opens to expose half of the 48-in, diam rotating worktable.

A single overhead wheel, powered by 10-hp motor, will throw 15,000 lb of



abrasive per hour; an optional 15-hp motor is available that will throw 22, 000 lb of abrasive per hour. For maximum abrasive efficiency, a self-contained automatic elevator and separator continuously clean used abrasive for recirculation to the wheel.

Pangborn Corp., Hagerstown, Md. T-10-36

#### Angle Swaging Machine

Swaging unit of this machine is positioned at a 45 deg angle to permit the operator to remain in a normal upright position while setting up and controlling the swaging operation. Design also permits easy handling of large size, long length hose assemblies.

Controls, gages and work center are all on the same visual plane. It requires minimum installation space and piping; gives easy accessibility to pump and reservoir for servicing, and providescenter of gravity for strength and stability.

The machine is made in two standard models—WH 51 HMD high-speed,



single phase, for 110/220 V circuit, 60 cycle; and WH 53 HMD high-speed, three phase, for 220/440 V circuit, 60 cycle. Either model can be equipped for any other power circuit.

Weatherhead Co., Fort Wayne, Ind. T-10-37

#### **Automatic Dynamometers**

Line of automatic motor test stands for production checking of electric motors of 1/50 to 1-hp capacity, including the miniature servo-motor range, is designed to completely test a motor in



three or more dynamic phases of torque, speed, and current characteristics. The units feature Magtrol's basic line of hysteresis brakes for dynamometer load members and four digit electronic tachometers to indicate motor speed. Seven basic dynamometer heads are available, covering the range from 1 to 750 in.-oz torque capacity.

A typical unit will check motors in

three phases as follows: No-Load check of speed and current; dynamic check of speed, torque, and current; second dynamic check of speed, load, and current at any point on the curve, or stall current and stall torque check.

This control sequence may be initiated manually by a single start button for each phase, or it may be sequenced automatically.

Untrained operators may use these units to test motors accurately.

Magtrol, Inc., Electro-Mechanical Div., College & Highland Ave., Box 193, Bridge Station, Niagara Falls, N. Y.

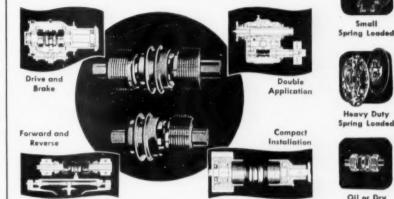
T-10-38

#### **Electronic Comparator**

The Micro-Ac electronic microcomparator is designed for precision gaging by users of gage blocks. The new amplifier and gaging stand provides laboratory precision but is suitable for production use. Measurements, to onemillionth of an inch, can be made with minimum skill.

Gage head, amplifier and stand makeup the complete microcomparator. Dimensional changes at the gage tip are shown on the meter magnified up to 100,000 times. Ten millionths of an inch change moves the meter pointer one

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inch. In use, the gage head is zeroed to the master dimension. The meter then shows how far offsize the gage block or part is from the master dimension.

Cleveland Instrument Co., 735-737 Carnegie Ave., Cleveland 15, Ohio.

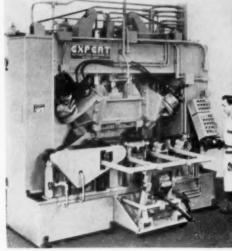
T-10-39

#### Transfer Forming Machine

Three-station in-line transfer forming machine produces four bends and contours in hot rectangular steel bars during one station operation to allow complete forming of the part while it remains at the required temperature for bending.

In the working station, an overhead hydraulically operated ram performs one bending operation while a hydraulically operated die set performs the three remaining bending operations. The machine can be adapted to a variety of parts requiring various bends and contours by changing the die set.

The 3-station forming machine occupies a floor space of about 5 x 10-ft and



is 11-ft high. Two 15-hp hydraulic power units operate all movements of the machine.

The forming machine, illustrated, which produces 500 formed automotive bumper support arms per hour, is an in-line transfer type machine in which the parts are automatically transferred from station-to-station by means of a hydraulically operated walking beam transfer mechanism.

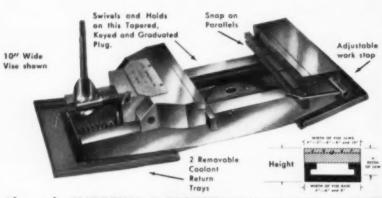
Expert Automation Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich. T-10-40

#### Positioning Motors

'Accurate remote power positioning without feedback reference is provided by two lines of motors. One is the step motor which indexes in 60, 30, 15-deg or smaller steps; the other device is an induction motor which provides continuously adjustable power positioning.

Continuously adjustable power positioning is obtained by operating an induction motor from an a-c adjustable voltage power supply so that positioning in any portion of a revolution is in relation to a voltage ratio. Adjustable voltage transformers, saturable reactors, and similar devices can be used to energize motors.

The motors have squirrel cage rotors and can be directly coupled to rotating



# The only <u>HARDENED & GROUND</u> SWIVEL MILLING MACHINE VISE

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The J&S CLAMPCUT Milling Vise multiplies the <u>clamping</u> and holding <u>power expected</u> of a milling machine vise. The adjustable jaw head and positive down-holding clamping action gives multiplied pressure.

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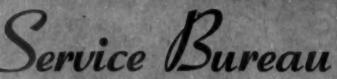
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Literature Number	COMPANY	DESCRIPTION
A-10-16	Acme-Danneman Co. Danneman Die Set Division	Die Sets-Catalog includes complete listings of standard and Swiss die sets, bushings and accessories. (Page 16)
A-10-233 A-10-263	Adamas Carbide Corp American Broach & Machine Div. Sundstrand Machine Tool Co	Carbides—"Grade A" Metallurgical Facts and Application Tipe" gives engineering details.  Broaching Machines—Practical broaching methods described in Bulletin
A-10-9	The American Tool Works Co	
A-10-290	Bedford Gear & Machine Products	
A-10-59	The Bellows Co	heads, Chuck jaws and peds.  Air Cylinders—Package work units, work and tool feeders, holding devices,
A-10-270	The Blanchard Machine Co	
A-10-190	Chicago Rivet & Machine Co	
A-10-225 A-10-162	The Cincinnati Shaper Co	
A-10-254-1	Covel Precision Grinders	
A-10-60	Crane Packing Co	., Wrapping-Folders contain data on production precision flatness and finish.
A-10-270 A-10-283	Delta Power Tool Division.	Die Supplies Catalog describes Daniy Die Springs and simplified method of selection.  (Page 43)  Drill Presses Booklet "Power Tools Team with Machine Tools" gives engi-
A-10-61	DeVlieg Microbore Division, DeVlieg Machine Co	
A-10-237	Eastman Kodak Co	
A-10-57	Elgin National Watch Co. Abrasives Division	(Page 237)
A-10-178 A-10-230	Famco Machine Co The Fellows Gear Shaper Co	Air Presses—Catalog gives line of Famco air presses.  Gear Shapers—"The Art of Generating with a Reciprocating Tool" gives engineering details.  (Page 239)
A-10-199	The Gaertner Scientific Corp	Microscopes Bulletin 147-56 describes models and gives specifications for toolmaker's use. (Page 199)
A-10-274	The Gardner-Denver Corp	Air Tools—Bulletin No. 101 describes Keller Tool multiple nut setter. (Page 274)
A-10-35	Gisholt Machine Co	Lathes Glaholt Masterline saddle-type turret lathe described in Bulletins 11-51. (Pages 34-25)
A-10-229	Greenles Bros. & Co	Automatics—Catalog A=05 contains information on Greenlee automatic bar machines. (Page 229)
A-10-5		Machine Attachments-Bulletin B&S contains data on Brown & Sharpe
A-10-251	Heller Tool Co	Saws-Heller Hack Saw Catalog gives information on sizes and types (Pages 250-251)
A-10-202	B. Jahn Mig. Co	Dies Catalog contains case histories and engineering specifications of B. Jahn dies. (Page 202)
A-10-185	Lamina Dies & Tools, Inc	Press Supplies Catalog contains information on guide pins and bushings for regular or special applications. (Page 186)

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A=10=180	Lapointe Machine Tool Co Broaches—Booklet "How to Care for Broaching Tools" gives engineerin pointers. (Page 180
A-10-200	Lepel High Frequency Laboratories Induction Heating-Catalog contains data on Lepel induction heating ap
A-10-313	P. J. Littell Machine Co
A-10-228-2	Lovejoy Tool Co., Inc
A-10-200	Marshall Steel CoSteel—Catalog contains specifications and prices on ground flat stock an
A-10-196	drill rode. (Page 206 Melin Tool Co., Inc End Mills—Tool catalog No. 54-C lists line of standard and mills and als
A-10-278 A-10-36 A-10-168-2	Harry Miller Corp
A-10-228 A-10-157	Nice Bell Bearing Co Bearings—Catalog No. 190 gives engineering specifications. (Page 22t Oakite Products, Inc Metal Cleaning—"Here's the Best Shortcut in the Field of Organic Finishing" and "For Power Washers, Oakite Composition No. 98," give engineering details.
A-10-70	Ohio Crankshaft Co Induction Heating Catalog shows "Typical results of TOCCO Heating for
A-10-148	Ortman-Miller Machine Co Cylinders—Bulletins 101A and 105 describe removable rod gland caruridges with the O-M series T-H hydraulic cylinders. (Page 14
A-10-215	The Producto Machine Co Die Sets-Producto die sets and accessories described in new catalog No. 1 (Page 21)
A=10-194	Reed Rolled Thread Die Co
A-10-156	Ring Punch & Die, Inc
A-10-60 A-10-171	Rivett, Inc
A-10-261-2	machines; shapers; and drill presses. (Page 28
A-10-197 A-10-149 A-10-192	The S-P Mfg. Corp
A-10-381	them" now available.  Sundstrand Machine Tool Co Special Machines—Facts about Sundstrand turning equipment available
A-10-231	Bulletin 784. (Pages 20-26 The Taft-Peirce Mig. Co
A-10-167	shows typical T-P comairmatic installations. (Page 23 The Tomkins-Johnson Co
A-10-224	The Torrington CoSpecial Machines—Rotary awaging machines described in catalog.
A-10-58 A-10-306	The U. S. Drill Head Co
A-10-175-1	THE REPORT OF THE PARTY OF THE

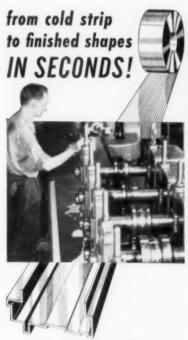
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#### YODER ROLL-FORMING MACHINES

If you are in the business of manufacturing a product that is, or could be, made wholly or partly from flat rolled metals in thicknesses up to ½", a Yoder Roll-Forming machine can help reduce your production costs.

Cold-formed shapes of every description—including structurals, tubular products, moldings, trim, roofing and siding, panels, cabinet shells, etc., can be produced on Yoder cold-roll forming equipment at the rate of 25,000 to 50,000 feet per day at a conversion cost of only a fraction of a penny per foot! With speeds and costs such as this, even part-time operation of a Yoder roll-forming line is a profitable investment!

Additional operations such as welding, coiling, ring forming, perforating, notching, embossing or cutting to length can be simultaneously introduced to the basic shape at little or no additional labor cost. Yoder engineers are at your service in explaining the advantages of roll-forming for your individual needs.

A new, revised, Fifth Edition of the Yoder Cold-Roll Forming book is just off the press. In addition to economic and mechanical possibilities of cold-roll forming, it contains numerous illustrations of end uses and applications of roll-formed shapes. Write for your copy today.

THE YODER COMPANY



COLD ROLL FORMING MACHINES

INDICATE A-10-175-1



shafts operating at high speeds without damage. They can be operated at slow speed and, without declutching, be driven at high speeds. They will stop and hold at a fixed point in a revolution, and two or more units may be accurately synchronized.

These motors can be operated as polyphase induction motors in the conventional manner as well as providing power positioning.

The B. A. Wesche Electric Co., Cincinnati 42, Ohio. T-10-41

#### Internal Diameter Gage

This portable comparator type gage for precision measuring internal diameters is entirely mechanical.

It covers size range from 3/8 to 1½ in. diam. and has a reading scale of 0.005 in., calibrated in 50 millionths graduations. Accuracy is within 20 millionths of an inch. Magnification is



1000:1. Scale is linear over full range. The gage can be set quickly and accurately to any desired size, is instant reading and repeats consistently. A movable face plate allows full exploration of holes up to 3%s in. max depth.

The compact unit is self-contained and requires no air or electric connectors.

Sunnen Service Corp., 7900 Manchester Ave., St. Louis 17, Mo. T-10-42

#### Hydraulic Planer

Created to take advantage of modern cutting tools and techniques, this heavy duty Hy-Draulic planer incorporates power rapid traverse, power rail elevation, automatic power rail-lock and Special Size
Reamers
ARE STANDARD
WITH L&I

TWO MORE
LAI
EXCLUSIVES
...AT
NO EXTRA
COST!

#### DOWEL PIN REAMERS

Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.

14 Sizes from .1230 thru .4995" Sets, tool

#### OVER & UNDER SIZE CHUCKING REAMERS

Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes. 14 Sizes from .124 thru .501" Sets, tool

These reamers are two more reasons why L&I is the source for a complete reamer line. See your L&I Distributor,



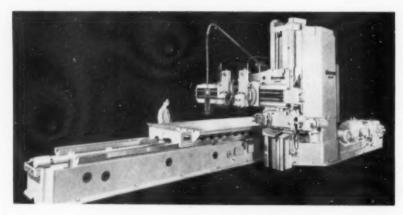
"the reamer specialists"

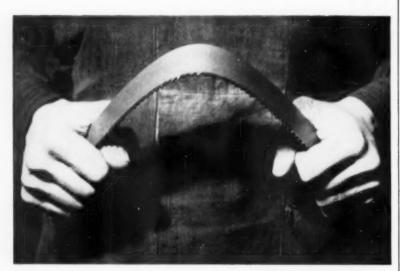
LAVALLEE & IDE, INC.

CHICOPEE, MASS. INDICATE A-10-175-2 automatic way lubrication. It has particularly heavy column, crossrail and head construction. A one-piece L-shaped rail construction assures continued accuracy over the full life of the machine. An adjustable sidehead rail provides accurate and permanent alignment of the sidehead with the rail heads.

This planer is available from 60 x 60 in, and larger, and may be had with either the conventional single circuit, or the high-speed h3 triple circuit. All movements of the heads are controlled from the pendant. On machines with the h3 drive, complete table control is also obtained from the pendant.

Engagement and actuation of all head





#### THIS is No Ordinary Power Hack Saw Blade

This is the unbreakable Marvel High-Speed-Edge Hack Saw Blade—the first bi-metal blade—invented, developed and introduced by Marvel. This blade is a combination of two materials best suited to the requirements of an efficient hack saw blade . . . a narrow high speed steel cutting edge permanently welded to a tough, non-brittle alloy steel body. Each blade is triple tempered to assure long life and maximum toughness to the cutting edge.

With a MARVEL Blade, you can cut any material—from the free machining steels to the toughest alloys . . . fast, accurately and economically. You can tension a MARVEL Blade from 200% to 300% tauter than any ordinary blade, permitting much higher speeds and heavier feeds without deflection or breakage.

Like all good things, attempted copies of the MARVEL Blade have been numerous, but its performance has been unequalled by any of the imitators. Ask for MARVEL Blades by name and you can be sure you're getting the best on the market. Leading Industrial Distributors have them in stock.

Write for latest cutting tool Bulletin and the name of your nearest



ARMSTRONG-BLUM MFG. CO. 5700 W. Bloomingdale Ave., CHICAGO 39, U.S.A. FOR FURTHER INFORMATION, USE READER SERVICE CARD, INDICATE A-10-176

feed and traverse movements also is possible from the pendant. Push-buttonoperated electrical clutches in the feed box control actuation of all feed movements. The counterbalanced swivelling pendant enables the operator to run the machine from any position.

A Tool-trol feature, an integral part of the head control, permits manual vertical and horizontal inching of either head from either end of the rail, or from the head itself.

Two-speed traverse motors allow maximum speed for approximate positioning, and slow speed for extremely close power positioning of the heads.

Rockford Machine Tool Co., Dept. 214, Rockford, Ill. T-10-43

#### Tool Setting Gage

This planer and shaper gage, designated No. 624, for precisely setting cutting tools on machines has beveled ways to avoid side play and provide accurate alignment and parallelism between the working surfaces.

With an extension usable on three surfaces, the gage has a range from <sup>1</sup>/<sub>4</sub> to 10 in. It incorporates a precision



level, and the platform has an extra tapped hole to accommodate a post for indicators and other accessories. Base and slide are steel forgings, and they and the extension are hardened and ground.

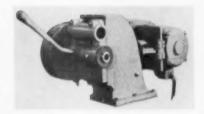
Brown & Sharpe Mfg. Co., Providence, R. I. T-10-44

# Air Line Filter

Automatic-drain air line filters with simplified design of drain mechanism provide efficient liquid removal at temperatures up to 200°F.

They operate at top efficiency at air line pressures as low as 5 psi for all models; and as high as 150 psi for the transparent bowl models and 250 psi for the new metal bowl type. They drain automatically, 24 hours a day, as long as there is pressure on the air system. The float-controlled, pilot operated drain mechanism discharges only when collected liquid reaches full capacity. Simplification of the drain mechanism results in fewer parts.

Specially designed louvers improve centrifugal action of the entering air



head feed make it into a semiautomatic production machine. For use with carbide or ceramic tooling, it can be equipped with a high-speed head and motor, to operate at selective spindle speeds to 5000 rpm.

Head and motor are balanced on a common, bearing supported pivoting arm for sensitive vertical movement. The motor bracket swivels to facilitate belt changing, with the steel guard hinged on top for additional convenience and safety. Pulleys are interchangeable.

Because reservoir and collecting area are cast into the standard base, a coolant system may be added easily.

U. S. Burke Machine Tool Div., Brotherton Rd., & Pennsylvania Railroad, Cincinnati 27, Ohio. T-10-46

# Welding Head

Designed to facilitate dual use of automatic welding equipment for welding metal cylinders and tanks, this automatic welding head is mounted on a carriage in such a manner that the welding of longitudinal seams is accomplished while the cylinder is clamped in a copper backup, air



and increase filtering efficiency in removing moisture and oil emulsions. For removing abrasive solids from the air, three interchangeable filter elements are available—74, 64 and 25 micron.

C. A. Norgren Co., 3400 S. Elati St., Englewood, Colo. T-10-45

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

# Milling Machine

Accessory combinations for specific applications make the No. 1 Half-Mill useful for applications ranging from use as an independent head mounted on any base to semiautomatic machining with air-hydraulic head and table feeds. Slotting, sawing, face milling, keyway cutting, slab milling, boring and many other operations may be handled with the unit.

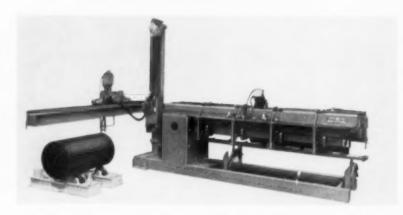
The basic machine, powered by a 1 or 2-hp motor, with rack and pinion head feed, may be equipped with a micrometer depth stop, screw manual head feed, and longitudinal screw feed table. Combination of 18-in, stroke air-hydraulic table feed and 4-in, stroke



clamped seaming fixture.

The manipulating fixture is then rotated to position the welding head over the cylinders mounted on variable speed turning rolls for the welding of circumferential welds. Equipment is available to weld any size or range of cylinders.

The seamer, illustrated, has capacity of 12 to 36 in. ID up to 12 ft long. Because of the air operated gap closing mechanism there is no need for pretacking. Roller conveyor system aids in loading and unloading. The welding head is mounted on self-propelled travel carriage. The boom rotates 360 deg and is equipped with power elevation.



The manipulator will accommodate any commercially available welding head. Pandjiris Weldment Co., 5151 North-

rup Ave., St. Louis 10, Mo. T-10-47

# Boring Bar Holder

This boring bar holder is quickly mounted on the lathe's compound tool post and utilizes power feed on the lathe carriage. Being mounted on an eccentric, the holder can be easily adjusted by repositioning the eccentric. The eccentric feature also permits the holder



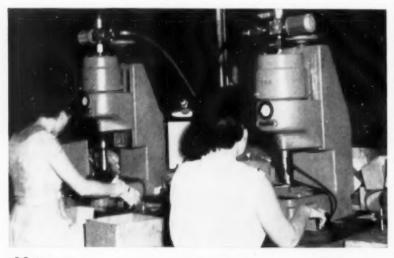
to be used on lathes with varying center heights. The holder accommodates round boring bars from 35 to 1 in. in diameter, using a universal collet. Bar can be adjusted for various depths. Square hole collets can also be supplied which accommodate square tool bits for use on counter bores and radii cuts.

Universal Engineering Co., Frankenmuth, Mich. T-10-48

# Punch Press

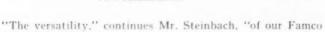
The redesigned Multi-Max punch press, in two and four post models, is available in capacities of from 40 to 125 tons. Speeds range from 40 to 1000 strokes per minute. Bolster and ram areas are from 2 x 2 ft. to 4 x 12 ft. Shut die height is unlimited.

Material can be fed from front to back, back to front and side to side. The two-hand control, with locking device on left hand control, affords safe one-hand operation. The hand switch is automatically off when foot switch is operable. Other features include key lock control on control panel, and auto-



# famco AIR PRESSESas important as our right hand!"

E. C. STEINBACH, vice president of Petice Dictation Systems



AIR PRESSES really pays us big dividends in speedy, efficient production and lower operating costs."

In fact, management at Peirce Dictation Systems-manufacturer of precision dictating systems for industry-has found that their two AIR PRESSES perform operations they never thought possible.

And, whether they are riveting, stamping or pressing the pressure is always smooth and full.

Find out today how your production line can benefit with Famco AIR PRESSES. With more than 40 models to select from-either single or double acting-you'll find a dependable Famco AIR PRESS that will give you plenty of versatility, can lower your manufacturing costs and speed production. Write for FREE catalog.



# amco machine company

3132 SHERIDAN ROAD . KENOSHA 10, WISCONSIN

AIR PRESSES - ARBON PRESSES - BAND SAWS - DRILL PRESSES - FOOT PRESSES . POWER PRESSES . SQUARING SHEARS . MILLING MACHINES

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matic stop on downward stroke of ram if operator takes hands off controls. In event of power failure, machine automatically "fails safe."

Diamond Machine Tool Corp., Pico, Calif. T-10-49

# Light for Checking Surface Flatness

Self-contained, portable monochromatic light for measuring flatness is 11 x 14 in, with a work stage size of 10 in, square. Heavy duty, 9000-volt transformer provides an average of 40-ft candle power at the diffusing glass. The light head may be tilted back and ad-



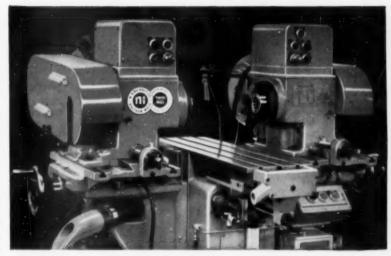
justed for height to permit maximum light on check area. On pieces too large for the work stage to hold, the light head may be swung around completely to permit checking work on the bench.

Crane Packing Co., Dept. TED, 6400 Oakton St., Morton Grove, Ill. T-10-50

# Die Filing Machine

Small size bench type die filer uses standard  $3\frac{1}{2}$  or 4-in, parallel machine files as small as 3/64 in, in diameter,

Rigid mounting design in the yoke holding the files assures positive accuracy. The yoke itself reciprocates on



Twin Mill

# NICHOLS MILLERS...

# Ideal Basic Machines for Automatic Production

NICHOLS MILLERS are versatile, work-devouring machine tools, unexcelled in accuracy and fine workmanship.



Nichols 8SA Semi-automatic

A NEW 16 mm. sound, color movie is available for free showing. May we reserve it for you? The TWIN MILL is practically TWO milling machines in ONE. Opposed Milling Heads have SIX-WAY adjustability for quick set-up and flexible approach to complex light milling operations. Push a button, and an automatic table cycle gives you TWO completed milling cuts. This unique duplex Miller is a cost-cutter without equal!

For high production precision milling where the double-barrelled approach of the TWIN MILL is not required, there are single spindle NICHOLS Semi-automatic Millers of varying work ranges. In addition to automatic table cycles, synchronized automatic downfeed of spindle head and automatic cross feeds are avail-

NICHOLS MILLERS have a magnetic attraction for the Tool Engineer's ingenuity.

Write for literature and illustrations.

you? Manufactured by W. H. NICHOLS COMPANY
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# This 86-inch



# **BROACH SECTION**

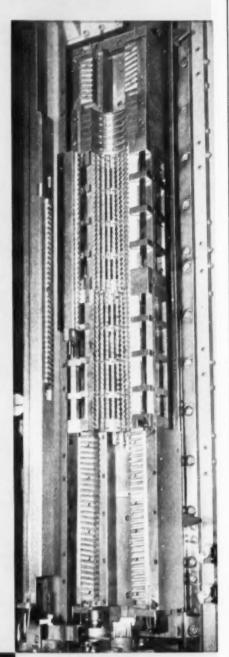
# broaches 5 surfaces in one pass

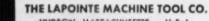
- · radius
- · flat, adjacent to radius
- one side, at 90° angle to the flat, and adjacent to it
- · two locating lugs

Using carbide-tipped broach sections to remove 1/8" to 3/16" stock per surface, a cast iron chain case cover is machined with mass-precision by Lapointe-Broaching—the fastest and most economical method of metal removal. Shown here, the 86-inch broach section is made up of a holder and master, and suitable sub-holders for ease of maintenance and handling.

At broaching speeds of 100 feetper-minute and more, on many applications it is possible to broach upwards of 100,000 pieces between sharpenings, with Lapointe inserted type carbide broaches. This is real production economy, and shows the wisdom of calling on Lapointe's long experience in designing and making broaching tools.

Send for free booklet
"How to Care for Broaching Tools"
Ask for Booklet No. 1





HUDSON, MASSACHUSETTS — U. S. A. In England, Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



two hardened steel rods traveling in precision-machine guides.

The unit has a 6-in, diameter tilting table, 1 in, stroke,  $3\frac{1}{2}$  in, throat, and  $1\frac{1}{2}$  in, work thickness capacity. It operates with a  $\frac{1}{4}$  hp electric motor at a speed of 375 strokes per minute.

High Speed Hammer Co., Rochester, N. Y. T-10-51

# Abrasive Cut-Off Machines

The Separex Tiger abrasive cut-off machine is designed to reduce dead times for clamping and bar feed. Material is clamped automatically through wheel feed. Stops are controlled automatically or by foot pedal. Dead times for advancing the bar, clamping, declamping etc. are reduced to 3-5 seconds.

F. Bläsi & Co., à partir ler 12.56 Blasi S. A., Soleure, Switzerland. T-10-52

# Bandsaw Guide

Designed to operate satisfactorily on saws cutting any material at any speed or load, Guidall 400 bandsaw guide provides a guide with edge of blade riding on the outside perimeter of thrust wheel and with thrust wheel and support rollers all operating on the inner raceway of the bearing. The





Guidall, which handles blade speeds up to 15,000 fpm, works equally well on light and heavy loads and will handle thrust loads to 175 lb at maximum speeds and to 500 lb at lower speeds. It accommodates saw blades from 3/16 to  $2\frac{1}{2}$  in.

For application requiring a wiping action on the blade the guide has support blocks instead of rollers.

Support wheels and support blocks easily adjust to accommodate thickness of the blade, or adjust for wear, without having to move the guide itself.

The unit may be converted from a support wheel to a block setup simply by replacing the wheels with support blocks.

Carter Products Co., Inc., Grand Rapids, Mich. T-10-53

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# **Cutoff Machine**

As many as 2,000 pieces of pipes and tubes ranging in size from  $\frac{3}{8}$  to  $1\frac{1}{4}$  in. OD in light gage to 16-ga wall thickness, can be cut per hour on this air-operated rotary cutoff machine.

The operator feeds the pipe or tube to a preset stop, touches the air valve



foot switch and the rotary blade descends at the desired cutting speed, cutting the material and leaving a clean, smooth edge.

A handle can be attached for manual operation. Adjustable pipe and tube support tables are available with nylon fork rollers to minimize scoring of material.

Continental Machine Co., 1952 N. Maud Ave., Chicago 14, Ill. T-10-54



Vibratory

# LAPPING MACHINES

Low cost, High speed lapping and polishing of parts in production quantities.

Syntron Lapping Machines save many man hours, and cut production costs by producting metallographic finishes and precision flat surfaces on component parts in production quantities. Their gentle vibration with variable speed control assures a positive polishing action on parts or samples where metallographic finishes are required.

Investigate how Syntron Lapping Machines can cut your production costs.

Easily installed—no expensive grinding equipment necessary. Low cost, dependable operation.

SYNTRON announces the opening of a laboratory with facilities for lapping and polishing test samples. Prompt return of test samples with recommendations in 10 days.

Builders of Quality Equipment for more than a Quarter-Century.

# Other SYNTRON Equipment of proven Dependable Quality ELECTRIC HAMMER DRILLS BIN VIBRATORY FEEDERS VIBRATORY FEEDERS

Write for complete catalog data - FREE

SYNTRON COMPANY
Homer City, Pa.

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# **NEW** design

OLOFSSON Precision Boring Machine

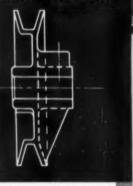
OLOFSSON

gives added production advantages

> OLOFSSON Model 30-012 Single End Precision Way Boring Machine

> PROVIDES FAST, ACCU-RATE ROUGH AND FINISH BORING, FACING, CHAM-FERING, TURNING AND GROOVING.

# A TYPICAL APPLICATION



Finish bore, turn o. d., groove, and chamfer zinc die-cast pulley.

Rate of Production: 190 pieces per hour.

# These 7 design features give you greater production efficiency . . .

- New design provides low height to width ratio of spindles to ways.
- Self contained hydraulic unit, separate from machine, for easy maintenance and elimination of heat problems.
- Standard commercial hydraulic components throughout.
- Nickel-iron, one piece ribbed base with integral fixture mounting pad and chip disposal basin.
- 5. Hardened and ground ways.
- Conveniently located push-button control panel.
- 7. Forced feed lubrication.

FIND HOW THE 30-012 FITS YOUR REQUIREMENTS. WRITE FOR LITERATURE.





THE

LOFSSON CORPORATION

2731 Lyons Ave., Lansing, Michigan

MANUFACTURERS OF PRECISION BORING MACHINERY AND SPECIAL MACHINERY



# Joint School-Industry Council Seeks Answer to Scientific Manpower Shortage

"Scientific manpower shortage can be ended only in the local classroom" by improved teaching of science courses from grade school through junior college was the warning expressed by Robert L. Clark, executive secretary of the President's Committee on Scientists and Engineers. Mr. Clark was one of the national authorities invited to speak to the nearly 100 delegates to the five day conference of leaders in science, education and industry who are trying to decide how industry and education can best cooperate to end the nation's scientific manpower shortage. Sponsors of the conference were the National Academy of Sciences and Hughes Aircraft Co. of Culver City, Calif.

Ellsworth S. Obourn, a science specialist of the U.S. Office of Education, pointed out that the number of new science and mathematics high school teachers had dropped more than 50 percent between 1950 and 1954. Teachers, businessmen and scientists from eight different states described local industry-education teamwork that had improved science instruction.

Outcome of the meeting was a plan for organized industry-education cooperation that could be used in the Southern California area first and extended to other areas.

Four specific actions of the delegates included:

Establishment of a permanent Southern California Industry-Education Council with a full time paid executive secretary and a five-man steering committee representing both industry and education.

Appointment of five area "salesmen" within the Southern California area, each with responsibility of getting together more industries and schools to improve science teaching programs.

Approval of a drive to raise funds from industry for operation of the new council and received informal assurances from industrial delegates that the needed money would be forthcoming.

Agreement to publish a manual, with backing of the National Academy of Sciences, to show other areas how to start their own industry-education cooperative programs.

Steps toward, world standardization for peaceful use of nuclear energy were taken by 61 delegates from 13 countries at the meeting in August of the International Organization for Standardization at Geneva, Switzerland. Six areas of work were outlined by the technical committee on nuclear energy. They include:

Development of a tri-lingual glossary of terms applicable to nuclear energy and based on work already done in various countries.

Development and approval of a warning symbol for use wherever danger from ionizing radiation is present.

Adoption of units pertaining to nuclear energy, developed by the International Commission on Radiation Protection and International Commission on Radiological Units.

Development of symbols required for drawings pertaining to nuclear equipment and installations.

Development of international recom-

mendations relating to measurement of radiation and protection against radiation.

Development of internationally acceptable guides for safe design, operation and maintenance of nuclear reactors,

A cost reduction course has been set up by the American Management Association for production executives responsible for performance of first line supervisors. The one week course, which will be given eight times in New York, Chicago, Los Angeles and San Francisco before June of 1958, is designed to teach them how to carry out a comprehensive, continuing cost reduction and control program.

Principal subjects covered will be major principles of cost reduction, guides for selecting areas in which cost-reduction efforts should be concentrated, financial and nonfinancial incentives, quality control, employee selection and training, accident prevention, methods improvement, scheduling, maintenance and replacement of equipment, and programming and controlling cost reduction.

### new ventures

Formation of a division to be known as Vidmar, Inc. has been announced by Volkert Stampings, Inc. The division, which will occupy a new 44,000 sq-ft plant in Williamsport, Pa., has acquired sole rights to manufacture in the United States and Canada an established line of tool storage cabinets, blueprint cabinets and other industrial storage equipment.

Entering the field of plastics production, Minneapolis-Honeywell Regulator Co. has begun full scale production of epoxy casting and potting compounds designed particularly for the electronics industry. Manufacturing operations are centered in the company's main plant in Minneapolis.

# new facilities

A \$23-million steelmaking plant which will introduce a steel production process involving a combination of hot blast cupolas and oxygen blown converters, is under construction for Acme Steel Co. in Riverdale, Ill. The plant, which is scheduled for operation early in 1959, will have an initial capacity of 450,000 ingot tons a year.

VVV

Construction has started on an ultra modern, \$5-million bearing plant in Indianapolis for Link-Belt Co. The new facility will increase by 50 percent the capacity of the company's present Dodge bearing plant. Construction is expected to be completed in 1958 and full production to be under way by 1959.

The Herman Stone Co. has opened a new manuafcturing plant in Mount Airy, N. C. The granite block structure, which cost more than \$100,000, is located near other production facilities at the quarry of the North Carolina Granite Corp.

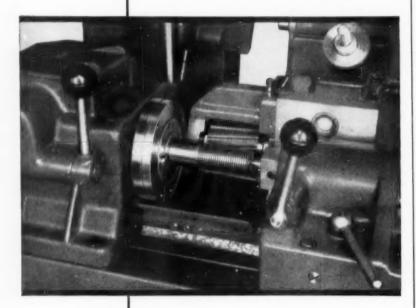
VVV

A multi-million dollar zirconium melting plant is being completed for Reactive Metals, Inc. in Ashtabula, Ohio. The plant represents the largest domestic facility for melting of zirconi-

VVV

Construction of a new plant for caster production in Jonesboro, Ark., is under way for The Colson Corp. According to company president, Robert

# ONE GOOD TURN



Hanson-Whitney Thread Milling Machines produce precision threads with one turn of the work. Featuring precision cutting of internal or external, straight or taper, left or right hand threads, H-W's great versatility boosts your production profit.

The Hanson-Whitney Thread Milling Machine features an exclusive cam design eliminating back lash, and providing a full automatic cycle for lead and depth plus rapid retraction, which speeds gaging and loading.

Hanson-Whitney's single source production integrity covers their complete line of machine and cutting tools, fixtures and precision gages. Consult H-W's complete home and field engineering service on all threading problems.

# Hanson-Whitney

Division of The WHITNEY CHAIN COMPANY
171 BARTHOLOMEW AVE. HARTFORD 2, CONN.

TAPS: THREAD GAGES: HORS: CENTERING MACHINES: THREAD MILLING MACHINES AND CUTTERS
FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-10-184

A. Pritzker, the plant, slated for completion this fall, was necessitated by Colson's broad diversification program. The facility, which will be 89,000 sq ft in size, has been designed for quick and economical expansion and will permit future expansion to a 270,000 sq ft building. It is expected to afford employment for about 220 persons.

A new plant for production of black granite surface plates has been completed in the industrial area near El Segundo and Crenshaw Blvds. in Hawthorne, Calif. for Collins Microflat Co. The facility has been scientifically designed for ideal lapping conditions.

Leasing of a new \$300,000 plant in Fall River for production of a new line of electronic industrial controls has been announced by Minneapolis-Honeywell Regulator Co. Employment in the 37,400-sq-ft plant is expected ultimately to total 200 persons. It will be a manufacturing unit of the company's Industrial division.

Midwest division headquarters at 5611 W. Lake St. in Chicago have been established by Allmetal Screw Products Co.. Inc. The operation will be headed by Tom Schaid.

# research

A research program in the areas of friction and lubrication, fatigue of materials and colloid science will be conducted by Rensselaer Polytechnic Institute under the sponsorship of Miniature Precision Bearings, Inc. E. I. du Pont de Nemours & Co., General Electric Co., Grumman Aircraft Engineering Corp., Shell Development Co. and Socony Mobil Oil Co.

# corporate changes

H. K. Porter Co., Inc. has acquired the business of The Cleveland Hardware & Forging Co. which now will be known as the Cleveland Div. Herbert E. White, president of the forging concern, will be in charge of the new Porter division as general manager.

VVV

Design, manufacture and sale of proportional metering, mixing and metered dispensing systems formerly supplied by Applied Engineering Associates now are handled by The Meter-Mix Corp. which will operate as a division of Federal Machine Tool Co. Marvin Schneider and Sol Schneider, both formerly affiliated with Applied Engineering, are now associated with Meter-Mix

coordinating technical liaison with customers requiring special process equipment studies.

VVV

Announcement has been made of the purchase of Drying Systems Inc. by Thor Power Tool Co. The acquired firm. which produces industrial ovens and process air conditioning installations, will operate as a division of Thor with the same management and personnel.

V V V

According to a joint announcement by the presidents of the two companies involved, Reliance Electric & Engineering Co. and Master Electric Co. have been combined. Cited as advantages for the consolidation were opportunities for diversification, wider markets, operating economies and more complete customer service.

VVV

Controlling interest in Berkeley-Davis, Inc., builders of special machinery and specializing in automatic arc welding equipment, has been acquired by The Federal Machine and Welder Co. Present sales and distribution outlets of Federal Machine probably will be used in distribution of Berkeley-Davis equipment. John P. Berkeley and Charles Davis, who owned and operated the company which bore their name, will continue with a substantial ownership and as operators of the firm.

### licenses

Exclusive license to manufacture and sell its No. 12 Fellows-Reishauer gear grinding machine in the United States and Canada has been granted to The Fellows Gear Shaper Co. by Reishauer Tool Works Ltd. of Zurich, Switzerland.

V V V

Sutton Engineering Co. has been licensed by Sir James Farmer Norton & Co., Ltd. to manufacture the English designed Farmer Norton centerless bar turning machines, rotary swaging machines, two-roll bar straighteners and polishers and strip flattening and cutting machines for the United States metal industries.

V V V

Licensing agreement granting The Weatherhead Co. rights to produce and sell Super Gem fittings for Teflon hose assemblies under Aeroquip Corp. patents has been concluded according to Aeroquip president, Peter F. Hurst. Production under the agreement, which covers applications in airborne and government equipment only, is scheduled to begin immediately.

At the same time, arrangements were

concluded with Weatherhead under which Aeroquip has rights to use certain patents and patent applications relative to crimped-on Teflon hose fittings.

### expansions

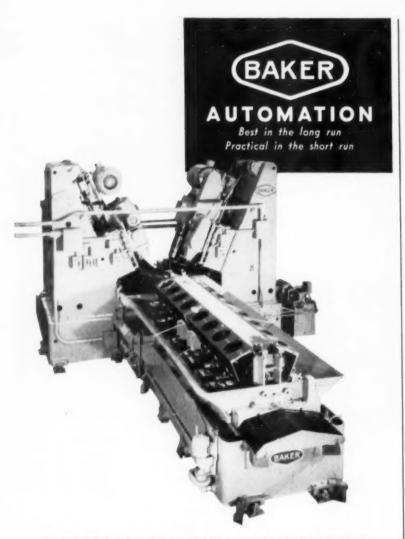
In connection with an over-all expansion of facilities, Valvair Corp. has completed a new product development and testing laboratory. It provides means for determining dynamic characteristics of all types of valves and for establishing engineering soundness of new designs. Testing facilities provide for high or low pressure air and vacuum tests, air and liquid flow metering, and both ac and dc electrical testing.

VVV

A \$50-million, 7-year industrial expansion program, which is adding nearly 100,000 tons of annual production capacity to its plants throughout the country, has been completed by National Carbon Co., Div. of Union Carbide Corp. Plants located at Columbia,



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-185



# NEW BAKER SPECIAL

bores diesel engine cylinder blocks - automatically

The latest of a long line of Baker special machine tools... operations are rough and finish bore and counterbore 6 to 16 holes for cylinder sleeves; drill dowel pin holes.

Compare with the early Baker special "Rotary" below — the man walked around the machine!



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-186

Tenn.. Niagara Falls. N. Y., Clarksburgh, W. Va., and Cleveland and Fostoria, Ohio, participated in the program which involved addition of new facilities and in equipment rearrangement and process improvements. A new plant at Lawrenceburg, Tenn.. using an unusual new process for forming and baking also is getting into production of carbon products.

Extensive rearrangement of its Schenectady manufacturing facilities has been undertaken by Alco Products, Inc. Initial phase of the program, which is costing in excess of \$1-million, is scheduled for completion in December.

Lukens Steel Co. has broken ground for a \$33-million project to permit increase of its rated ingot capacity by nearly 25 percent, and increase the rolling capacity of its mills by about 40 percent within two years.

Size of the manufacturing facilities of the Computer division of Bendix Aviation Corp. will be doubled as a result of the expansion program now under way in Los Angeles.

M. A. Ford Mfg. Co.. Inc., has started full production in its new plant and office building at 1545 Rockingham Rd., Davenport, Iowa. The new structure roughly triples the company's previous facilities.

# production notes

Through a recently developed method to statically cast 60-in. long Meehanite bars under exact metallurgical control, Compton Foundry of Compton, Calif. is stocking bars with precise uniform diameter in eleven sizes ranging from 3 to 8 in. in diameter. The new molding technique produces a bar of dense, fine grained, stable metal, free of porocity and which has no parting line.

A line of segmental cold cutting saws made in England by Firth Brown Tools, Ltd., will be sold and serviced in the United States by Ernest F. Dönley's Sons, Inc. The Insto segmental saws are available in sizes from 11 through 72 in.

Standard Pressed Steel Co. has set up a separate manufacturing and sales division to meet needs of conventional and nuclear power plant builders for special stud type fasteners. The new Precision Stud Div., located at the company's Jenkintown, Pa. headquarters plant, is starting out with nearly \$500,000 worth of advanced research and metalworking equipment. It is produc-

ing critical large-diameter fasteners of a type required for major structural fastenings in power plant steam turbines, nuclear reactors, chemical process vessels and other large high temperature, high pressure equipment.

## worehouses

A steel service plant, which has been under construction since early this year, is now operating in Indianapolis, Ind. for Joseph T. Ryerson & Son, Inc., warehousing subsidiary of Inland Steel Co. Representing an investment of more than \$1-million, the plant will serve Indianapolis and southern Indiana.

Allegheny Ludlum Steel Corp. has opened a tool steel warehouse in Newark to serve its New York sales territory. It will stock a complete range of sizes in tool, die and high-speed steels.

Latrobe Steel Co. has opened a southern regional warehouse and office at 4342 E. 10th Court in Hialeah. Fla. Devoted exclusively to tool and die steels, the facility will service customers in Florida, Mississippi, Alabama, Georgia, North and South Carolina. Howard M. Givens is southern regional manager directing the facility.

### moves

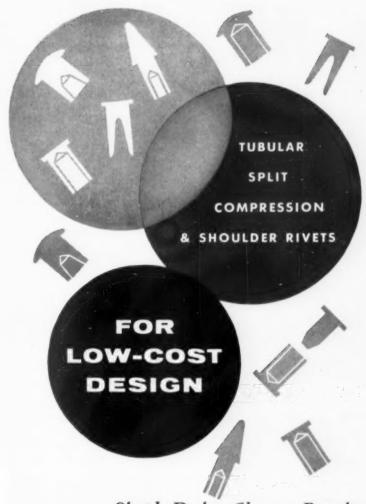
The Drop Forging Association will move its headquarters about November 1 to new offices on the 11th floor of the Illuminating Building now under construction in Cleveland, Ohio.

Magnecord Div. of Midwestern Instruments, Inc. has been moved from Chicago to Tulsa, Okla. Midwestern acquired the tape recorder manufacturing firm last December. All management personnel and most of the skilled and technically trained personnel are being moved to the new location. Service and repair functions of the organization already have been moved and are in operation in Tulsa.

# anniversaries

Twenty-fifth anniversary celebrations are being observed by Tenney Engineering, Inc., considered oldest manufacturer of environmental test equipment.

Rezolin Inc. is making preparations to mark its 20th anniversary in the plastic tooling industry. The company, which began as a one-man operation, consumed almost 14 million pounds of plastic materials in 1956.



# Simple Design Changes Permit STANDARD RIVETS to Replace Costly "Specials"

We produce a wide variety of special fasteners for our customers . . . but only when we have to! Only when a standard rivet just won't fit the application. We bring our experience, skill and engineering know-how to every job, large or small. It's a challenge to see if we can't modify designs to substitute an inexpensive "standard" rivet for a more costly "special".

To improve product appearance and strength
... to take full advantage of automatic assembly
... to cut delivery time and production costs
—get in touch with Milford first!



# MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT . HATBORD, PENNSYLVANIA ELYRIA, OHIO . AURORA, ILLINOIS . NORWALK, CALIF.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-187

# rade iterature

for free booklets and catalogs—use convenient request card, page 173

# **Boring Bars**

Spiral bound 38-page Catalog No. 58 lists 332 standard general-purpose bo:ing bars; includes complete application, dimensional and carbide data; engineering illustrations and flip charts facilitate selection of correct boring bar for specific use. DeVlief Microbore, Div. of DeVlieg Machine Co., 2720 W. 14 Mile Rd., Royal Oak, Mich. L-10-1

### **Industrial Rollers**

Illustrated 4-page brochure describes non stop express rollers for moving machinery easily, safely and economically; drawings show features of construction and assembly; includes table of specifications and dimensions, lists prices and outlines recommended applications, Hilman Equipment Co., P. O. Box 81, Sea Girt, N.J. L-10-2

### Lubricants

Twenty-four page illustrated manual, "Jet Age Lubricants," covers development, testing and application of engineered lubricants to meet jet age requirements; contains section on Military Specifications and Their Significance. Charts and graphs demonstrate physical properties of products in comparison with petroleum lubricants. Lehigh Chemical Co., Chestertown, Md.

L-10-3

# the Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Co., Inc., THE Union Ave., Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Precision Rotary Tables, Motorized Centers and a complete line of Hole Location Accessories.

# 7 Tricks of the Trade in Jig Grinding Small Holes

The following tricks of the trade will prove helpful in jig grinding small holes with a diamond charged mandrel:

1. Uniformly graded diamond powder should be used for charging mandrels. Holes from minimum (1/64") to about 3/32" in diameter should be roughed and finished with 80-100 grit powder. Larger holes may be roughed somewhat more rapidly with a coarser grade, 60-30 grit,

2. Avoid bellmouth by preventing the mandrel from leaving the hole at either end.

3. Since a freshly charged mandrel will cut much more rapidly than a worn one, avoid introducing a freshly charged tool as a hole nears size, Fig. 1.

4. Do not permit the uncharged shank of a mandrel to contact the surface being ground. Frictional heat will burn both the work and the mandrel. The former, partially annealed at point of such contact, will charge with diamond out and probably be ruined.

5. It is generally more economical and efficient to consider mandrels as expendable and make a new one for each job, Since the cost is only a few cents, use of an old one, or even the time spent trying to match one to requirements, is hardly justified.

6 Because mandrels cannot be trued with a diamond, it is necessary to measure both the top and bottom of a hole

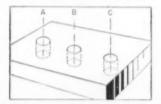


Fig. 1. In grinding three holes to size, A and B are roughed to within 001"—002", and C within about 005". Using a freshly charged mandrel, C is finished to size, thereby breaking down the high points on the tool. A and B may now be safely ground Bo piza.

while grinding, in order to avoid a ridge

7. In view of point 6, it is advisable to set the work up on parallels of sufficient height to enable measurement from beneath the workpiece, Fig. 2.



kpiece is mounted high enough to ing bottom as well as top of hole.

### Get ALL the answers from this new, 424-page book

The information on this page is just a sample of the valuable, on the jud aid you can get from Mone's all one book, HOLES, COYTOURS AND SURFACES. Tells you have to produce tools, dies and precision parts the modern may. 428 pages. 495 illustrations. where Send check or me

184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Price only \$5 in U.S.A., \$6 elseorder to Moore Special Tool Co., Inc., 732 Union Ave.,

### Solenoid Valves

Indexed for convenient reference, 114-page Solenoid Valve Catalog No. 25 covers engineering information, 2, 3 and 4 way type solenoid valves, manuai reset 2 and 3 way valves, corrosion resistant valves and selection guide, special purpose valves and accessories, and special valves for nuclear reactors. guided missiles, U.S. Navy, dispensing machines, etc. Includes construction details flow diagrams and cross section views; gives instructions for selecting valves for specific applications. Request only on company letterhead direct from Nicholas W. Fleno, Asst. Director of Sales Promotion, Automatic Switch Co., Florham Park, N.J.

## Special Metals and Alloys

Information on heat resistant alloys, abrasion resistant materials and new alloys for severe processing conditions presented in 22-page Shieldalloy brochure on pure metals, master alloys and ferro alloys. Lists chemical analysis as well as powder mesh sizes for each of the alloys. Shieldalloy Corp., Newfield, N.J.

## Casting Materials

Technical Data Bulletin T-22 discusses materials and methods for fabrication of tools from plastics and their successful use for special machining fixtures. Allied information dealing with laminates is presented in Bulletin T-21. Houghton Laboratories, Olean, N.Y. L-10-5

# Contour Wheel Dressers

Six-page technical brochure outlines inclined plane cam mechanisms for dressing grinding wheels with intricate contours. Illustrates typical contours, Hoglund Engineering & Mfg. Co., Inc., 343 Snyder Ave., Berkeley Hts., N.J.

L-10-6

**Grinding Fixture** 

Brochure explains use and operation of Grind-All fixture designed for attaining high accuracy, wide range and maximum speed in grinding perforators; photos show various irregular shapes which can be ground by the fixture, applications and special features. Harig Mfg. Corp., 5757 W. Howard St., Chicago 31, Ill.

L-10-7

### Carbide Tools

Details on line of carbide tipped drills, reamers, end mills, countersinks, milling cutters, counterbores and centers presented in 36-page illustrated Catalog 57; includes dimension tables and price lists. Super Tool Co., Sales Dept., 21650 Hoover Rd., Detroit 13.

L-10-8

### Abrasive Belt Grinders

Bulletin 110 covers design, characteristics and possible applications of new heavy duty and extra heavy duty abrasive belt Swing-frame grinders recently added to company's line for difficult grinding jobs. Grinding and Polishing Machinery Corp., 2530 Winthrop Ave., Indianapolis 5, Ind. L-10-9

**Metalworking Facilities** 

Facilities for contract welding, maching, gear cutting and press rebuilding described and illustrated in 32-page brochure; covers type of equipment available for these services, capacities and capabilities; extensively illustrated. Request copies only on company letterhead directly from Verson Allsteel Press Co., 9300 S. Kenwood Ave., Chicago 19, Ill.

**Press Feeding Units** 

Operating principles, features, specifications and typical applications of the 9 and 12-inch Rol-Di-Feed self-contained cam-operated units designed to feed material or coiled stock to presses explained in booklet illustrated by photos and drawings. H. E. Dickerman Mfg. Co., 321 Albany St., Springfield, Mass.

L-10-10

Castinas

Information on custom made centrifugal castings in more than 70 different alloys presented in comprehensive Catalog 200; easy to use tables cover useful engineering data; lists 86 significant applications in 13 major industries. Sandusky Foundry and Machine Co., Sandusky, Ohio.

L-10-11

# **Cutting Materials**

Four-page folder presents advantages of high-velocity, metallic cutting material called NewMet; makes performance comparisons with other cutting materials on specific jobs. Newcomer Products, Inc., Latrobe, Pa. L-10-12

**Multispindle Automatics** 

Sixteen-page illustrates line of Wickman multispindle automatics with accompanying tables of dimensions and specifications. Carney-Stansfield Co., 270 E. Hamilton St., Allentown, Pa.

Clamping System

Illustrated 8-page Catalog 557 describes Clamp-N-Jack setup system for use with boring mills, planers, milling machines, presses and drill presses; shows typical applications on various types of machine tools, gives case history data and explains function of all components. Universal Vise and Tool Co., Parma, Mich.

L-10-14

Alloys

Up-to-date information on four nickelbase alloys presented in 104-page "Hastelloy Corrosion-Resistant Alloys" booklet; describes chemical composition, physical, mechanical and high-temperature properties; includes table of comparative resistance of the alloys to more than 250 corrosives commonly handled in various industries, and gives laboratory penetration data supplemented with graphs showing penetration rates. Separate section describes techniques for forging, cold working, machining, grinding and welding of the alloys. Advertising Dept., Haynes Stellite Co., Div. of Union Carbide Corp., 420 Lexington Ave., New York 17, N.Y.

L-10-15



(Standard and Special)





To produce more work in less time and at reduced costs, modern production methods often require multi-diameter tools that perform a combination of operations with each pass—drill-counterbore, drill-ream, drill-chamfer, etc. Your best bet for accomplishing these objectives are subland cutting tools, precision produced by Detroit Reamer & Tool Company.

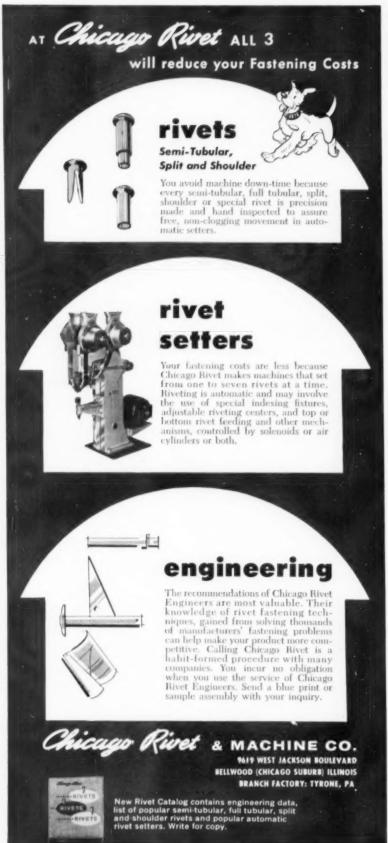
A leading participant in the original development of subland tools more than 25 years ago, Detroit Reamer & Tool Company has been a major manufacturer of such tools ever since. Thus, our engineering experience combined with modern manufacturing facilities assure that you receive the finest quality subland cutting tools.



# & TOOL COMPANY

780 W. MAPLE RD. . P.O. BOX 174 . BIRMINGHAM, MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-189



# Welding of Steel Castings

Comprehensive 52-page reference manual, "Recommended Practice for Repair Welding and Fabrication Welding of Steel Castings," contains material gained from research project conducted by Battelle Memorial Institute under sponsorship and direction of Steel Foundry Research Foundation. Tempil® Corp., 132 W. 22nd St., New York 11, N.Y.

L-10-16

# Marking

Pictorial, 72-page, spiral bound reference Catalog 14 describes case histories of marking machine installations in various fields and discusses how they have been used to solve cost or production problems. Geo. T. Schmidt, Inc., 4100 Ravenswood Ave., Dept. T.E., Chicago 13, Ill.

L-10-17

### **Blind Rivets**

Features of CKL Conical Keystone Lock blind rivets described in well-illustrated 16-page brochure; easy-to-follow line drawings show step-by-step driving cycle of the fasteners; gives complete dimensional data and specifications and provides part number conversion charts. Huck Mfg. Co., 2480 Bellevue Ave., Detroit 7, Mich.

L-10-18

# Hard Surfacing Electrodes

Line of Murex Hardex hard surfacing electrodes discussed in 20-page booklet which provides charts associating the electrodes with different surfacing applications. Includes information on how to decrease porosity, cracking, penetration and weld dilution. Gives physical and chemical properties of typical deposits for each of 16 electrodes. Metal & Thermit Corp., Rahway, N.J.

L-10-19

# Locking Sealant

Technical Report No. 5 offers information on how to lock threaded fasteners with Loctite sealant; specific uses and methods of application are documented for various threaded products; also gives information on techniques for sealing and soldering sleeve joints; includes fundamental data on basic principles of thread locking with plastics; discusses physical properties of the material. American Sealants Co., 103 Woodbine St., Hartford 6, Conn.

L-10-20

# Milling Cutters

Forty-nine types of solid high-speed steel milling cutters designed for machining aluminum. light metal allows and ferrous materials described in illustrated 32-page Catalog HSS-1; contains complete specifications for each cutter and accessory tool holders. Goddard & Goddard Co., 12280 Burt Rd., Detroit 23, Mich.

# **Power Transmission**

Engineering charts, tables and formulae to help designers select right gears and speed reducers for specific jobs included in 186-page 1957 handbook; tabulates complete dimensions on Ohio standard spur, bevel, spiral, helical, worm gears and steel rack; gives specifications, dimensions and mechanical information necessary to select proper reducer in relation to required ratios, horsepower, torque and installation dimensions. The Ohio Gear Co., 1333 E. 179 St., Cleveland, Ohio.

**Engineering Service** 

Divided into sections by industry for convenient reference, 32-page pocket-size booklet, "Working for Profit," discusses improved methods that cut costs and advanced equipment that suggest ideas for new products and markets in metalworking, process, maintenance, mining, foundry, transportation and utilities fields; includes on-the-job illustrations. Whiting Corp., Harvey, Ill.

L-10-22

# **Rivets**

Line of pull through and self plugging blind rivets described in illustrated 10-page bulletin which lists advantages of the two types and their typical applications. Technical data covers material specifications, recommended hole sizes and shop practice notes; also gives tables of specifications and application data. Huck Mfg. Co., 2480 Bellevue Ave., Detroit 7, Mich.

L-10-23

# **Power Plants**

Pocket sized Blue Book of general information concerning selection of engine driven electric generating plants, describes in easy-to-understand language the three general groups of electric plants and thoroughly discusses plant operation for each type; also reviews three types of prime mover which furnishes mechanical power for driving generator; compares differences of engine cooling, starting methods, D. W. Onan & Sons, Inc., Minneapolis, M. L. 10. 24

**Heating Equipment** 

Extensively illustrated Bulletin 57-108 describes various applications of radiant heating equipment in metal processing; 18 typical applications covered in capsule case history form; includes data on product heating problems, processing temperatures, time cycles and oven design; describes four sources of infrared energy and where they are best applied to metalworking heating processes. Fostoria Pressed Steel Corp., Fostoria, Ohio.

L-10-25



# Now! A Complete Line of Self-Locking Microsize UNBRAKO Socket Cap and Set Screws

Nos. 0, 1, 2 and 3 in alloy steel and stainless steel are available with the Nylok\* feature

You effect major economies in time and money when you design and assemble small devices with self-locking microsize Unbrako socket screws. These close tolerance screws won't work loose. They simplify standardization of small devices where maximum reduction of weight is required without sacrifice of strength. They eliminate the necessity of designing costly special screws to fasten tiny parts in compact assemblies and they prevent the waste of production time while waiting for delivery of special screws.

In addition to having the overall advantages of microsize Unbrako socket screws, these screws can be used in holes tapped in soft or die cast materials without stripping threads and ruining expensive work. Also the set screws can be used with hardened shafts, since they lock against the threads of the tapped hole.

All Unbrako socket screws can be supplied with the self-locking Nylok feature. The Unbrako with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Seated or not, the screw locks positively wherever wrenching stops, won't work loose—because the tough resilient nylon pellet forces mating threads together.

Ask your authorized industrial distributor for details today. He carries complete stocks of self-locking Unbrako socket screws (caps and sets from #0 through 1 in., button heads #4 through 1/2 in.). Or write us for literature and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 37, Pa.

\*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

We also manufacture precision titanium fasteners. Write for free booklet.



4		- L		5	HEAT-TREATED ALLOY STEEL Self-Locking Microsize UNBRAKO Socket Cap Screws Class 3A Threads						
Screw Size		Threads per in.		L Over-	Pellet Location		Torque				
		NC	NF	Length	NC	NF	Max. prev.	ist off stat. min.	Sth off stat, min.		
	A .104	_	80	1/6	_	.047	5.5	14.0*	7.0*		
# 0	B .060	-	80	3/16	-	.047	5.5	14.0*	7.0+		
	D .060	_	80	1/4	-	.047	5.5	14.0*	7.0		
	F .050	-	80	3/6	-	.047	5.5	14.0*	7.0		
#1	A .118	_	72	1/4		.047	11.0	28.0*	14.0*		
	B .073		72	3/16	_	.047	11.0	28.0*	14.04		
	D .073	-	72	1/4	-	.047	11.0	28.0*	14.04		
	F .050	-	72	3/8	-	.047	11.0	28.0*	14.0+		
# 2	A .140	56	-	3/16	.063	-	24.0	3.0	1.5		
	B .086	56	-	1/4	.063	-	24.0	3.0	1.5		
	D .086	56	_	3/4	.063	-	24.0	3.0	1.5		
	F 1/16	56	-	1/2	.063	-	24.0	3.0	1.5		
# 3	A .161	48	-	3/16	.063	-	40.0	6.5	3.0		
	B .099	48	-	1/4	.063	_	40.0	6.5	3.0		
	D .099	48	-	3/8	.063		40.0	6.5	3.0		
	F 564	48	-	1/2	.063	-	40.0	6.5	3.0		

\*Measured in in.-gm. (those not marked with a star are measured in in.-oz.)

HEAT-TREATED ALLOY STEEL Self-Locking Microsize UNBRAKO Socket Set Screws

bad be-fd					Class 3A Threads					
Screw Sixe		Throads per in.		L Over-	N Pollet Location		Torque			
		NC	NF	Length	NC	NF	Max. prev. on	1st off stat. min.	Sth off stat. min.	
	D 040	-	80	3/12	-	.047	5.5	14.0*	7.0*	
#0		-	80	1/4	-	.047	5.5	14.0*	7.0*	
	D .060 F .028		80	5/32	-	.047	5.5	14.0*	7.0*	
	F .028	-	80	3/14	-	.047	5.5	14.0∗	7.0*	
		-	80	1/4	-	.047	5.5	14.0*	7.0*	
			72	1/4	-	.062	11.0	28.0*	14.0+	
	D .073 F .035	-	72	3/10	-	.062	11.0	28.0*	14.0+	
		-	72	3/14	-	.062	11.0	28.0*	14.0+	
		-	72	1/4		.062	11.0	28.0*	14.0+	
# 2	D .086 F .035	56		1/6	.062	-	24.0	3.0	1.5	
		56	-	5/60	.062	-	24.0	3.0	1.5	
		56	-	3/14	.062		24.0	3.0	1.5	
		56	-	1/4	.062	-	24.0	3.0	1.5	
	D .099 F .050	48	-	5/32	.093	-	40.0	6.5	3.0	
		48	-	3/16	.093	-	40.0	6.5	3.0	
		48	-	1/4	.093	-	40.0	6.5	3.0	

\*Measured in in.-gm. (those not marked with a star are measured in in.-oz.)

Self-locking microsize Unbrako socket cap and set screws are available in sizes #0 through #3, in heat treated alloy steel (plated or unplated) and stainless steel, at your authorized industrial distributor. He also carries a complete stock of other self-locking Unbrako socket screws.

Jenkintown \* Pennsylvania

Standard Pressed Steel Co. • The Cleveland Cop Screw Co. • Columbia Steel Equipment Co., Inc. • Cooper Precision Products • Standac Conada Ltd.

Unbraka Socket Screw Co., Ltd.



Harold G. Zambell was made engi-

neer in charge of test and development

at Allis-Chalmers Terre Haute (Ind.)

Works. He has been engineer in charge

of development at the firm's Pittsburgh

Works for the past 15 years. Succeeding

him in that capacity is William C.

Farneth who has been associated with

transformer development work at Pitts-

Micromatic Hone Corp. has promoted

John H. Greening to the post of chief

engineer. He has been associated with

the company for the past seven years.

Named assistant chief engineer is Ed-

ward L. Behringer, who has been ac-

tive in Micromatic's electrical control

Donald E. Fry has been named chief

engineer of Copeland Refrigeration

Corp. Associated with the firm since

1937, he has been instrumental in de-

sign and development of Copeland com-

At The Carpenter Steel Co., Basil T.

Lanphier, metallurgist for stainless and

high temperature alloys, was named

manager of research, and Howard O.

Beaver, former plant metallurgist-melt-

ing, was promoted to production metal-

lurgist in charge of melting and hot

pressors and condensing units.

At Shultz Steel Co., W. H. Meyer has assumed duties of technical director and M. W. Mills is the new regional sales director serving midwestern aircraft industries. Mr. Meyer formerly was chief metallurgist for the Green River Steel Corp., and Mr. Mills was general superintendent at Green River.

George J. Zimmerman, formerly director of engineering and recently acting controller-treasurer of The Carborundum Co., was elected controller of the company and its United States, Canadian and Australian subsidiaries.

Carl B. Willer, formerly manager of Vitrified Project Development of the Bonded abrasives division of The Carborundum Co., was made director of the engineering division of the functional

Appointment of William A. Minix as chief gage engineer has been announced by Freeland Gauge Co. He joins Freeland Gauge after 25 years association with Delco Products Div. of General Motors where he headed the gage engineering department.

Kennecott Copper Corp. has made Lowell B. Moon development manager of the company. He will direct engineering phases of the company's exploration activities.

Robert W. Frank was elected vice-president of Birdsboro Steel Foundry & Machine Co. and will serve primarily as a sales executive. He formerly was vice-president, mill machinery sales, of Blaw-Knox Co.



for three years.

burgh.

design since 1941.



Kenneth P. Martin has been appointed vice-president and general manager of LeMaire Tool & Mfg. Co. Prior to joining LeMaire, he served as vice-president of National Automatic Tool Co.

working.



Reginald G. Schuler, for-

merly director of engineer-

ing of Badger Meter Co., is

new general engineering

manager of Brush Elec-

tronics Co, where he will

direct the product engineer-

According to announcement from Baker Brothers, Inc., Stephen B. Sponder was made plant manager of the company.

Stanley M. Norwood was appointed assistant to the president of Electro Metallurgical Co. division of Union Carbide Corp. He will continue in his capacity as vice-president of the division.

Another announcement from Union Carbide revealed appointment of George E. Drake to the office of vicepresident in charge of sales of Electro Metallurgical Co. He formerly was assistant general manager of the corporation's Silicones Div.

Wales-Strippit has announced appointment of Russell A. Johnson as general sales manager. He has been general sales manager for the company's North Chicago division.

Robert C. McNeill is now chief engineer of the Martin-Decker Corp. and will be responsible for new product development and engineering research, He formerly was with Shell Oil Co.

New head of project engineering for Adamas Carbide Corp. is John D. Knox. Before joining Adamas, he was production manager of the Sintercast Corp. of America.

> Robert L. Strawbridge was named vice-president and general manager of Wales-Strippit Co., a unit of Houdaille Industries, Inc., and will be responsible for all phases of manufacturing, engineering and sales.



October 1957

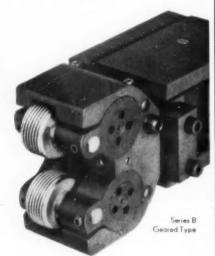


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Model No.	Complete Diameter Range	*Pipe Threads That May Be Rolled	Approximate Number of Common Screw Threads That May Be Rolled		
B 8	0-1/2"	5	70		
B 10	0.5/8"	7	80		
B 13	1/8".13/16"	9	90		
B 18	1/4"-11/8"	15	105		
B 36	3/4"-21/4"	18	185		

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Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukse, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto R. F. Mallina, inventor and authority on solderless wrap connection, has joined the Gardner-Denver Co. as a research consultant. Recently retired from Bell Telephone Laboratories, Inc., Mr. Mallina now will work with the Keller Tool Div., concentrating his efforts on commercial application of the connections.

Three promotions at Dana Corp. involved Ray Reed, who became chief engineer of the railroad division, Norman Revenaugh, now mechanical transmission engineer, and William Trisler, universal joint engineer.

Roy Norton was made assistant director of engineering at Long Mfg. Div. of Borg-Warner Corp. Mr. Norton, who previously served as transmission engineer, joined the Detroit Gear Div. of Borg-Warner three years ago.

Charles B. Morgan, formerly superintendent of molding and assistant manager of production at Synthane Corp., is now general manager of production. Associated with Synthane since 1944, he succeeds **Duane E. Roland**, who retired after 28 years of service.

Thor Power Tool Co. recently announced appointment of John Trumble as factory manager of the Aurora (III.) Works and of William J. McGraw as manager of the company's electric tool sales division.

Announcement from Lindberg Engineering Co. has made public the appointment of Charles A. Mueller as chief engineer of the new Gas Process Div. The division will handle development of atmosphere gas generation processes.

Raymond E. Mattocks has been appointed manager of industrial engineering, Western Brass Mills division, Olin Mathieson Chemical Corp.

Stanley J. Miller was made assistant director, plant engineering division of Joseph T. Ryerson & Son, Inc. Associated with Ryerson since 1941, he has been plant engineer.

The Waterbury Farrel Foundry & Machine Co. has announced appointment of C. Vincent Sciullo as assistant manager of the cold heading machinery division. He has been manager of the company's Cleveland sales office.

Anson W. Krickl was made general manager of manufacturing by Badger Mfg. Co. Since 1953, he has been associated with Catalytic Construction Co.

Alco Products, Inc. recently elected John P. DeLaney a vice-president. He formerly was general manager of the company's transportation division.

# technical horts

A VALUABLE METHOD for dressing bonded, metal diamond wheels has been developed. Through experimentation and actual use, Cratex Mfg. Co. has determined that

rubberized abrasive blocks because of their cushioned action flow around and

Rubberized Abrasives Dress Diamond Wheels

between the diamond particles and do a quick, thorough job of cleaning away smear metal and clogging in the diamond wheels. According to J. C. Craven, company president, rubberized abrasives do not tend to knock the diamond particles loose from their metal bond. Diamond wheels are restored to their free-cutting action quickly and easily, and their life is considerably lengthened.

A NARRATED, color film on modern steelmaking in Sweden has been released by Uddeholm Co. of America. The viewer is taken on an educational

Steelmaking Process Filmed tour of the industry's highly modernized steelmaking process, from the mine to the finished product.

It follows progress of the ore from pig and sponge iron to steel, and covers methods of producing billets, strip steel, wire rods, tool steel bars, stainless steel, seamless tubes, etc.

To obtain the 16 mm movie which has a 30-minute running time, contact Uddeholm, 155 E. 44th St., New York 17, N. Y.

Development of a continuous sulfur removal process has grown out of research on desulfurization of iron conducted by Battelle Institute for Diamond

Alkali Co. In the new process, molten iron and caustic soda are fed continuously into an apparatus where

New Technique Removes Sulphur From Iron

desulfurization occurs as the materials are intermixed. Desulfurized metal and

caustic flow continuously from the apparatus into molds or ladles.

A jet of oxygen introduced into the mixing chamber makes it possible to remove substantial amounts of silicon at the same time the sulfur content is being reduced.

Under laboratory conditions, the technique has been used to achieve 90 percent reductions in sulfur content, according to Battelle technologists N. H. Keyser and H. W. Lownie. Because of the low final sulfur content, the process promises to be useful in production of ductile cast iron as well as in the desulfurization of pig iron prior to conversion into steel.

Desulfurization occurs rapidly because thin layers of reacting materials are used. Samples taken during heats at Battelle's pilot-plant laboratory indicated that it takes less than a minute for completion of the sulfur removal reaction after addition of caustic soda.



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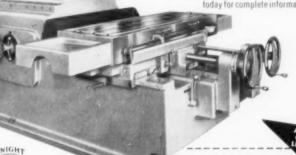
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Title

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Oct. 4-5. AMERICAN CERAMIC SOCIETY. Refractories division meeting, Bedford Springs Hotel, Bedford, Pa. More information may be had from society headquarters, 4055 N. High St., Columbus, Ohio.

Oct. 6-9. ELECTROCHEMICAL SOCIETY INC. Fall meeting, Hotel Statler, Buffalo, N.Y. Write to society, 216 W. 102nd St., New York 25, N.Y., for more data. Oct. 7-9. ILLINOIS INSTITUTE OF TECH-NOLOGY. National electronics conference, cosponsored by two other universities and two technical societies, Hotel Sherman, Chicago, Ill. Send inquiries to National Electronics Conference, Inc., 84 E. Randolph St., Chicago 1, Ill.

Oct. 7-9. American Society of Lubrication Engineers and American Society of Mechanical Engineers. Joint lubrication conference, Royal

York Hotel, Toronto, Ont. Further information may be obtained from Wilfiam P. Youngelaus, Jr., administrative secretary, 84 E. Randolph St., Chicago I. III.

Oct. 7-11. AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS Fall meeting, Morrison Hotel, Chicago, Ill. For details write 33 W. 39th St., New York 18, N.Y.

Oct. 9-11. Gray Iron Founders' Society Inc. Annual meeting, Drake Hotel, Chicago, Ill. Complete details may be obtained from society office, National City-E. 6th Bldg., Cleveland 14, Ohio.

Oct. 13-17. PRESSED METAL INSTITUTE. Annual meeting, Castle Harbor, Bermuda. Direct inquiries to institute headquarters, 3673 Lee Rd., Cleveland 20, Ohio.

Oct. 17-18. Armour Research Foundation and Illinois Institute of Technology, sponsoring national conference on industrial hydraulics, Hotel Sherman, Chicago, Ill. Inquiries may be sent to Raymond D. Meade, conference coordinator, IIT, 3300 S. Federal St., Chicago 16, Ill., or conference secretary of ARF, 10 W. 35th St., Chicago, Ill.

Oct. 17-18. Magnesium Association. Annual convention, Biltmore Hotel, New York, N.Y. For more facts, contact association headquarters, 122 E. 42nd St., New York 17, N.Y.

Oct. 17-19. NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS. Fall meeting, Grand Pacific Hotel, Bismarck, N.D. Other facts may be had from society office, 2029 K. St., N.W., Washington 6, D.C.

Oct. 21-23. THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. New developments conference, Americus Hotel, Allentown, Pa. Send inquiries to society office, 29 W. 39th St., New York 18, N.Y.

Oct, 21-25. NATIONAL SAFETY COUNCIL. 45th annual national safety congress and exposition, Conrad Hilton, Congress, Morrison and LaSalle hotels, Chicago, Ill. Further information may be obtained from society office, 425 N. Michigan Ave., Chicago 11, Ill.

Oct. 23-25. NATIONAL FLUID POWER ASSOCIATION. Fall meeting, Hotel Statler, Washington, D.C. For other data contact association office, 1618 Orrington Ave., Evanston, Ill.

Oct. 24-25. AIRCRAFT ELECTRICAL SO-CIETY. 14th annual display, Pan Pacific



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Auditorium, Los Angeles, Calif. Display director is Edward Ryerson, 380 Entrada Dr., Santa Monica, Calif.

Oct. 24-25. COMPUTER APPLICATIONS Symposium, sponsored by Armour Research Foundation of Illinois Institute of Technology Hotel Sherman, Chicago, Write to secretary of the symposium, ARF, 10 W. 35th St., Chicago 16, Ill. for details.

Oct. 24-25. Engineering Institute on EFFECTIVE DRAFTING, University of Wisconsin, Dept. of Engineering, Madison, Wis. Primarily aimed at helping chief draftsman become a better supervisor and to better organize his department. For details contact Robert A. Ratner, director, engineering institutes, The University of Wisconsin, University Extension Div., Dept. of Engineering. Madison 6. Wis.

Oct. 27-30. AMERICAN GEAR MANU-FACTURERS ASSOCIATION. Fall meeting. Edgewater Beach Hotel, Chicago, Send for other information to One Thomas Circle, Washington 5, D.C.

Oct. 27-31. Atomic Industrial Forum and AMERICAN NUCLEAR SOCIETY. Annual meeting and trade fair of the atomic industry, Plaza Hotel and New York Coliseum. New York, N.Y. Details are available from Atomic Industrial Forum, 3 E. 54th St., New York 22. N.Y.

Oct. 28-31. SOCIETY OF INDUSTRIAL PACKAGING and MATERIALS HANDLING ENGINEERS. National Industrial Packaging and Handling Exposition, Convention Hall, Atlantic City, N.J. Contact the exposition management, Hanson & Shea, Inc., Suite 759. One Gateway Center, Pittsburgh 22, Pa.

Oct. 30-Nov. 3. NATIONAL TOOL & DIE MANUFACTURERS' ASSOCIATION. Annual convention. Edgewater Beach Hotel, Chicago, Ill. More details may be had from association headquarters, 907 Public Souare Bldg., Cleveland 13, Ohio.

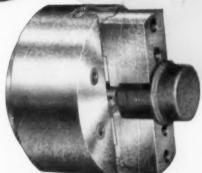
Oct. 31-Nov. 1. INSTITUTE OF RADIO ENGINEERS. Annual conference, Professional Group on Nuclear Science. annual meeting. Henry Hudson Hotel. New York, N.Y. Write for information to W. A. Higginbotham. IRE-PGNS. Brookhaven National Laboratory, Upton, L.I., N.Y.

Oct. 31-Nov. 2. NATIONAL METAL Trades Association. Annual convention, Conrad Hilton Hotel, Chicago, Ill. For other information, write association office, 337 W. Madison St., Chica-

Oct. 31-Nov. 2. Engineers Joint



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COUNCIL, Scientific Manpower Commission, National Science Foundation and National Academy of Sciences-National Research Council will jointly sponsor a national conference on engineering and scientific education. Edgewater Beach Hotel, Chicago, III. Write Engineers Joint Council, 29 W. 39th St., New York 18, N.Y., for more data.

Nov. 1-3. METAL TREATING INSTITUTE. Annual meeting, Sheraton Hotel, Chicago, Ill. Direct questions to institute office, 271 North Ave., New Rochelle, N.Y.

Nov. 2-8. American Society for Metals. National Metal Exposition and Congress and annual meeting, International Amphitheatre and Palmer House, Chicago, Ill. Second World Metallurgical Congress also will be held in conjunction with this meeting. Society office, 7301 Euclid Ave., Cleveland 3, Ohio, can supply details.

Nov. 4-6. AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Machine tool conference, Hotel Schroeder, Milwaukee, Wis. Institute offices, 33 W. 39th St., New York 18, N. Y. can supply more information.

Nov. 4-6. Society of Automotive Engineers. Diesel engine meeting, Statler Hotel, Cleveland, Ohio. Contact SAE office, 485 Lexington Ave., New York 17, N. Y. for details.

Nov. 6-8. Industrial Management Society. Time and motion study clinic, Sherman Hotel, Chicago, Ill. More facts may be had from society office, 35 E. Wacker Dr., Chicago 1, Ill.

Nov. 6-8, Society of Automotive Engineers. Fuels and lubricants meeting, Statler Hotel, Cleveland, Ohio. Send for details to SAE office, 485 Lexington Ave., New York 17, N. Y.

Nov. 11. Society of Plastics Engineers, Inc. Regional technical conference on "Plastics for Air-Borne Electronics," Ambassador Hotel, Los Angeles, Calif. For details, write to L. J. Costanza, 8017 Holy Cross Pl., Los Angeles 47, Calif.

Nov. 11-13. Institute of Radio Engineers. Instrumentation conference and exhibit. Biltmore Hotel, Atlanta, Ga. Send inquiries to B. J. Dacher, School of Electrical Engineering, Georgia Institute of Technology, Atlanta, Ga.

Nov. 13-15. AMERICAN STANDARDS ASSOCIATION. Eighth National conference on standards, St. Francis Hotel, San Francisco, Calif. Request details from association headquarters, 70 E. 45 St., New York 17, N.Y.



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# abstracts of By M. Kronenberg Consulting Engineer

# Honing Operations

Axial velocity in honing operations has a greater effect on the quality of the surface finish than the circumferential speed (cutting speed) of the honing tool, according to a report by G. Kessler published in Technische Mitteilungen 1957, Vol. 50, pages 11-12. The author indicates that the angle of overlap has an optimum value of about 45 deg and that the contact pressure should be low, about 2 kg/sq cm = about 28 psi. This value, however, is often exceeded for reason of speed.

Comparing ceramically bonded honing tools with sintered diamond tools, the author came to the conclusion that the latter have a longer tool life, produce a rougher surface, permit a greater production and that the geometric shape produced by them is greater. Their cost is higher and the surface finish poorer than that with ceramically bonded honing tools, making them profitable only in mass production.

# Stress Distribution in **Cutting Tools**

Stress distribution between cutting edge and the area of contact was investigated by W. Katwinkel, reporting on his findings in Industrie Anzeiger 1957. Vol. 79 (36), pp. 525-532 under the the "Untersuchungen an Schneiden Spanender Werkzeuge mit Hilfoder Spannungsoptik." In contrast to previous findings the author claims that considerable forces exist at the back of the tools. He shows that such a condition can exist in the case of stresses set up inside an infinite wedge when a given load is applied to its edge.

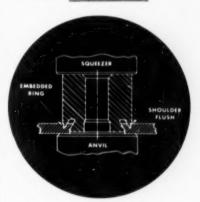
# **Energy in Chip Formation**

According to tests carried out by F. Eugene and discussed by him in Microtecnic, 1957, Vol. 11, pp. 67-70, Issue Number 2, the specific cutting force, or unit cutting force per square inch, is proportional to the chip cross sectional

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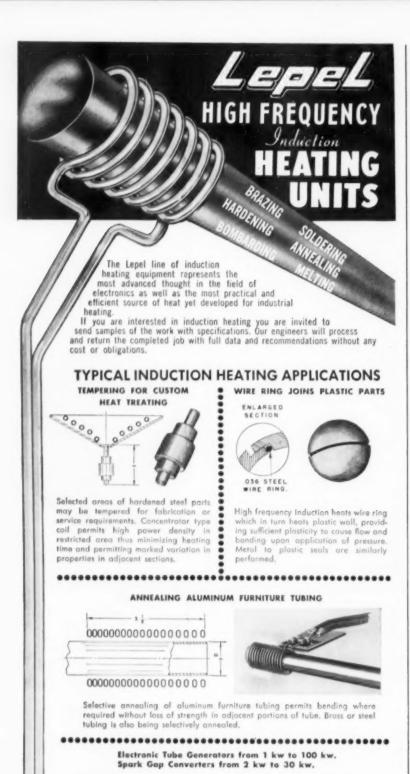
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area under certain conditions of cutting speed and rake angles. This finding is in contrast with findings of others, whose results indicate that the unit cutting force decreases with increasing chip cross sectional area. The author has also made tests of the metallographic transformation that results from a rise in the temperature of the chips, particularly in steel chips and, to a lesser degree, with copper chips. A diagram correlates the various phenomena associated with chip formation and plasticity of the work material under optimum conditions.

# Tool Dynamometer

In the same issue of the Swiss magazine Microtecnic, G. L. Ten Horn and R. A. Scheuermann describe a tool dynamometer (pages 59-66), stressing the importance of measuring the forces occurring in metal-cutting. The instrument consists of a head, a thin-walled measuring tube and a thick-walled tubular shaft. The strain gages are mounted on top and bottom of the outside of the thin-walled portion to measure the main cutting force. The measuring tube is deflected by the main cutting force and the top gage subjected to tension while the bottom gage is under compression. Using the principle of the Wheatstone bridge, an automatic potentiometer records the cutting forces acting at the tool. The authors are measuring the influence of chip dimensions, cutting speed, tool wear and other factors on the main cutting force in an effort to standardize machinability investigations.

# **Cutting Sheet Metal**

There are relatively few research projects undertaken that deal with cutting of sheet metal, although many operations depend on a better understanding of what is going on when sheet metal is punched. F. W. Timmerbeil has investigated the punching of sheet metal and reports on it in Vol. 47, Issue Number 7, 1957, of Werkstattstechnik und Maschinenbau, July, pages 350-356 under the title "Untersuchung des Schneidvorganges bei Blech, insbesondere beim geschlossenen Schnitt." The article deals with the finish of the surfaces cut under various conditions and with the means for improving them. The author found that a built-up or overhanging portion is left on the blank when the clearance is small, say up to 0.120 in. The surface of the hole, however, is mostly smooth. In the case of small clearances it is possible to produce satisfactory surfaces, although the rounding at the top side and development of burrs can hardly be avoided when the tools are growing dull.

Larger clearances cause rougher surfaces. These conditions change with the

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type of workpiece and material. In the case of higher tensile strength the shearing begins at less penetrations than with less brittle materials.

Built-up particles appear also in brittle materials when the strip is heavier than about ½ inch and when the clearance is small. Aluminum and other soft materials do not show a built-up appendix due to the fact that metal is smeared over the cut surface, producing a good finish, even though the clearance is small.

The specific load or stress on the inside fibers decreases when the tools are dulling and for this reason also the surface finish extends over a larger area than with sharp tools. It would not, of course, make sense to use dull tools for producing smooth surfaces because the amount of burr increases then. The author discusses the case where several stacked strips are cut. He came to the conclusion that the cut corresponds to that obtained in single strip of the thickness of the sum of the individual strips.

Design of these tools depends upon the method adopted; that is whether the scraping is to be done in one operation or whether several shaving cuts are to be taken in sequence, and how close the tolerances are to be held for interchangeability. Factors affecting the design include clearance, work material and thickness of the strip. Diagrams show the stock required for various materials and various thicknesses of the strips, both for the hole and for the blank. Numerous photomicrographs, profile measurement data and other diagrams are included.

# Tool Wear and Cutting Force

The shape of the wear zone on the tool face, particularly at high cutting speeds, indicates that the wear is dependent on temperature in the opinion of E. Y. C. Sun and W. B. Heginbotham, who authored an article in *Microtecnic*, Vol. 11, (2) 1957, pages 71-75, on this topic.

Distribution of heat flux at the chiptool interface is assumed to be a function of the pressure distribution. They investigated the crater being formed when machining 0.3 percent carbon steel. By viewing hardness indentations with an optical microscope, distances of various points were found with respect to the origin of a coordinate system. A sapphire gramophone needle served as a stylus for the microscope and was located at the bottom of the impression as the position of the lowest reading. The wear center was established and trends found with regard to the pressure and temperature distribution. They concluded that the chip cools the tool in the vicinity close to the tip of the

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MECHANICS FOR ENGINEERS—STATICS AND DYNAMICS—By Ferdinand P. Beer and E. Russell Johnston Jr., Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price \$8.672 pages.

In addition to covering separately the fields of statics and dynamics, the book takes up in each field the mechanics of particles and the mechanics of rigid bodies. This convenient, logical arrangement enables one to more easily determine the right method of solving a specific type of problem.

The book also gives you a unified approach to the broad field of mechanics by using together the concepts of free-body diagram, equivalence of systems of forces and dynamic equilibrium.

The importance of the free-body diagram is stressed throughout, not only in solving equilibrium problems, but also in expressing the equivalence of two systems of forces or two systems of vectors. In its treatment of statics, this volume provides information and data on rigid bodies in two and three dimensions. In addition it describes the analysis of forces in trusses, frames, machines, beams and other structures.

Rubber—Fundamentals of its Science and Technology—By Jean Le-Bras and translated by Irene E. Berck. Published by Chemical Publishing Co., Inc., 212 5th Ave., New York 10, N. Y. Price \$12, 464 pages.

This book covers the entire rubber field including synthetic elastomers, latices of both natural and synthetic rubbers and even the pertinent plastics. It is written especially for the busy rubber chemist and technologist, beginner and student, who have no time to untangle the details they really need from a maze of compiled literature.

Chapters are devoted to plantations, plant improvement, economical considerations, raw rubber, latex, synthetic elastomers, hard rubbers, reclaims, rubber derivatives, compounding ingredients and finished products.

The theoretical aspects of rubber chemistry, the most recent manufacturing methods, machinery and testing equipment, as well as the applications of rubber, are described in detail. There are also sample formulae for compounding typical rubber articles both from natural and synthetic rubbers. Also natural rubber and the elastomers in current use are evaluated and compared, and the advantages of representatives of one or the other group are pointed out for certain applications.

Special attention is given to the principles of selecting the most suitable compounding ingredients to meet the specifications placed on the finished product.

Tool Design, 2nd Edition—By Cyril Donaldson and George H. LeCain, Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price \$6,75, 557 pages.

Review by John M. Denuel, Chairman, Education Committee, Greater Lancaster Chapter 89.

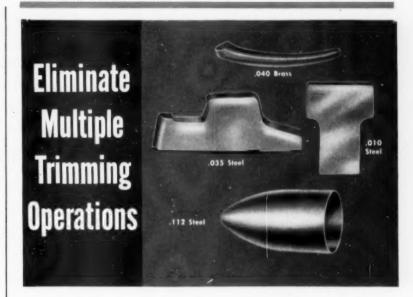
Tool drafting standards and manufacturing processes are covered in two chapters of the text. Another well-written chapter on welding, plus a brief chapter on Tolerances and Allowances is offered. Three chapters, i.e., Elementary, Details and Practical Design of Jigs and Fixtures, plub problems and illustrations, are well presented.

On the whole, the book can be used as a reference for typical problems in tool design by the executive, engineer, or any member of a manufacturing team that is interested in the production of high-quality tools at low production costs.

Engineering Metallurgy — By The Committee on Metallurgy. Frank T. Sisco, Advisory Editor. Published by Pitman Publishing Corp. 2 W. 45th St., New York 36, N. Y. Price \$7.50, 537 pages.

This book was developed to present in a concise, understandable manner the principles of ferrous and nonferrous metallurgy for all engineers—student and practicing. Both graduate and undergraduate student engineers need a fundamental knowledge of the metals they will employ in their work. The emphasis, throughout therefore, is on metallurgical principles rather than on handbook information. Specific data is given so as to provide a realistic structure to reinforce the theoretical presentations.

The practicing engineer who has had little contact with the field of metallurgy, or who has had no formal work in the field, will find in this book a sufficiently complete summary of all of the essentials he needs to know to obtain a broad understanding of the field.



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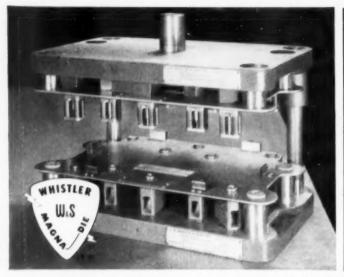
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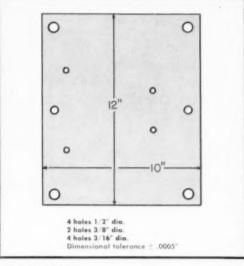


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# Whistler Magna-Dies open the way to big savings

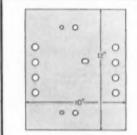
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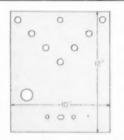


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This Whistler Magna-Die unit includes a 12" x 14" die set, 10 punch and 10 die retainers, 10 punches, 10 die bushings, 10 strippers, 3 gages and one set of templets. The complete price with templets jig bored and gages mounted for producing the 10-hole part shown above: \$819.00. The approximate cost of a custom die to do the same job: \$925.00. From the very start, you start to save with a Whistler Magna-Die.



8 holes 1/2" dia. 2 holes 3/16" dia 2 holes 3/8" dia. 1 oval hole 3/8" x 1/2" Dimensional tolerance ± .0005"



1 hole 31 32" dia 1 hole 3 8" dia 7 holes 1 2" dia 2 holes 3 16" dia 1 aval hole 3 8" x 1 2" Dimensional tolerance 5 ,0005"



6 holes 1/2" dia. 4 holes 3/16" dia. 2 holes 3/8" dia. 1 aval hole 3/8" x 1/2" Dimensional tolerance + .0005"

### \$710 SAVED ON JOB NO. 2

All of the original punch and die parts (with the exception of 2 punches, 2 bushings and 2 strippers) are re-used here. The additional tooling required, plus bored templets with gages mounted, cost \$389.79. The approximate cost of a custom die to produce this part; \$1100. Savings pile up with each succeeding job...\$816 so far.

### \$793 SAVED ON JOB NO. 3

Through the use of another punch and die retainer unit, a <sup>31</sup>½" punch, die bushing and stripper plus a new set of bored templets with gages, this part is produced at a die cost of \$246.81. In this case, the cost of a custom die would amount to approximately\$1040.00. Savings now reach \$1609.

# 5925 SAVED ON JOB NO. 4

As more Whistler punch and die parts are accumulated, die costs for each succeeding job usually go down even further. Here, for example, only a new set of templets, jig bored to the 13-hole pattern, is needed. The cost: \$163.55. A custom die for this job would run approximately \$1089.00. Total savings for these first 4 jobs alone amount

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# TEMPLATE TOOLING for

# SHORT-RUN STAMPING

. . . cuts lead time . . . die costs

By W. R. Wilson

Manufacturing Mgr. Automotive Div. A. O. Smith Corp. Milwaukee, Wis.

Model changes in the automotive field have a tremendous impact on operations. A company that is a supplier is confronted with a momentous task of tool changes, new tools, etc., which ofttimes peak up in certain months, not only beyond limits of the company's facilities, but beyond limits of available outside sources. This is the type of situation that led to the use of the template tooling to be discussed.

In this business, normal processing of a group of stamping tools for a given part places the blanking tool as the last tool to be considered. In other words, the process is as follows:

- The form tool must be designed, material procured, and the tool must be fabricated
- 2. The form tool is tried out
- 3. The approved formed part dictates the blank size required
- The blanking die may then be fabricated to the determined blank

In a tight program, the tool that is required for the first operation or blanking, is actually the last tool fabricated.

Material represents a substantial portion in the cost of automotive products and, consequently, the size and nesting of blanks become an all important consideration for establishing a steel ordering pattern.

Fig. 1. Template type tooling is set up in the die. Punch is in place on the bottom bolster, rule die in the top shoe. Some time ago, when in a new tooling program, concern arose over meeting blanking tool dates. At that time a process patented and licensed by Template Industries, Inc., Brooklyn, N. Y., was investigated with the thought of providing temporary tooling for initial production requirements. It was planned to use these in advance of fabrication of the permanent tools.

This type of tool is made of plywood and heat-treated steel rule, rubber, glue and mild steel. It can be made very rapidly and will blank low carbon content steel up to <sup>1</sup>4 inch in thickness. Only relatively simple and inexpensive equipment is required for the fabrication of this tooling. Also, only a moderate level of skill is required.

To process a die, such as shown in Fig. 1, the following steps are performed: From a part print, a master blank or even paper sketch of the con-

tour of the part is scribed on plywood. This is drilled with access holes for the jigsaw, and the entire outline of the blank is sawed out. Next, selection of the proper size of steel rule is made. Then, the rule is cut and fit to the contour of the male part of the plywood board or master blank. The steel rule is then heat treated ..ubber is added to provide for stripping material from the die. The rubber strippers are glued into position.

ech Digests

After the rule has been formed, Fig. 2, and assembled, Fig 3, the completed die proceeds to the surface grinder for the bevel or land angle to be ground

Next, after completion of the die, is development of the punch section. Tool steel for this varies with stock thickness of the material to be blanked. Material from ½ to ¾ inch has been used satisfactorily. The punch section of





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Fig. 2. Bending the rule steel to shape is one of the simple fabricating steps.



Fig. 3. The rule die is assembled to the plywood cutout of the part contour.

the tool is processed as follows: Tool steel sections are mounted to 14-inch mild steel backing plate or punch plate with bolts and dowels. The punch, together with completed die, is mounted in the shoe of the press. The press is actuated and outline of the die transferred to the tool steel punch. Piercing punches, if required, are pointed to locate holes for drilling. Next, the tool steel is removed from the press and the punch is fabricated. It is then hardened and ground the same as the steel rule, Rubber is added for stripping purposes. Total elapsed time for construction of one of these sets may be less than six hours. Of course, building time will vary according to complexity of the die and special requirements. To date, about 200 dies of various types and sizes have been constructed. One of the important features in the use of this type of die

is the fact that it is light and compact, can be stored easily in racks built for the purpose.

# **Production Experience**

In production as high as 250,000 pieces have been secured from a single die. Quantities on other dies vary, depending on needs, from 100 pieces to this maximum, but other quantities from 30,000, 80,000 and 120,000 have been produced.

While there are drawbacks and limitations to this type of tooling, for the purpose for which it was intended it proved most satisfactory. Those interested in low-cost tooling for short-run production may well consider this type of tooling worthy of investigation. While it is reported that other metals, including aluminum, magnesium, vanadium and titanium, as well as fow and high-carbon stainless and alloy steels, have been formed, A. O. Smith Corp. has had no occasion for experimentation to verify this.

In the matter of costs, these can vary widely, depending upon size and complexity of the tool. Observation indicates, however, that cost of this type of tooling should not exceed 10 percent of the cost of a permanent tool. Of the number that have been fabricated, costs have varied from \$50 to \$500 for an individual tool. A typical example of the type of contour and part for which this is used is shown in Fig. 4. This lowcost type of blanking tool appears to be most applicable to the following situations:

- 1. When tools are needed on short lead time
- 2. When expert diemakers are in short supply
- 3. When short-run production in-

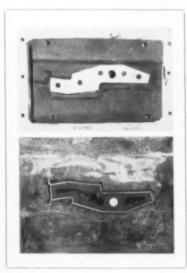


Fig. 4. Typical rule die and punch for an automotive part.

volves excessive tool costs

 When production tolerances permit, use of this type of tooling as a cost reduction project.

The initial outlay of funds for facilities is moderate and possibilities could well justify the expenditure. The processing steps of these dies are comparatively simple, with the potential for future experimentation on different types of metals and forming operations almost unlimited.

From a paper "Template Tooling" No. 130, given at the Society of Automotive Engineers summer meeting, headquarters address, 485 Lexington Ave., New York 17, N. Y.

# Trends in Production

By Glen R. Fitzgerald Chief Engineer, Automotive AC Spark Plug Div. General Motors Corp. Flint, Mich.

Improvements in manufacturing processes come in an evolutionary rather than in a revolutionary way. All of the worthwhile work of production engineers seeking to improve today's and tomorrow's manufacturing processes and methods has one or more of these objectives: (a) improved product quality, (b) reduced product cost, or (c) improved working conditions for plant employees.

The process development group of GM is engaged in making practical use of new knowledge which results from research. This group is not engaged in manufacturing research in the pure academic sense of undertaking investigations to broaden basic knowledge of nature and its laws. Rather, all of the work is guided by the practical aims mentioned.

Probably the greatest immediate opportunity to improve labor utilization in the future does not lie in the development of new process techniques or in special equipment. Rather, it is in using modern methods, engineering techniques and procedures to insure that even the smallest increments of expended effort are productive. Capitalizing on this opportunity requires that equally careful study be given to the manual portion of any job as is usually given to the mechanical portion. Many plants have realized tremendous improvements with their added investment being only the training of production engineers and supervisors in methods engineering principles.

Assembly is an area that has been traditionally manual and offers great



potential for continual improvement through the application of methods engineering. Beyond this point, however, a great deal is being accomplished in the development of mechanical assembly equipment. One GM division alone has over 100 semiautomatic and automatic assembly machines in operation.

Spark Plug Assembly Machine illustrates a development made in cooperation with the AC Spark Plug Div. to assembly the various components of an automobile spark plug. The only manual operation involved with this equipment is loading of the insulator assembly. Fragility of this vital part dictates the use of manual assembly means.

One of the major ways to reduce product cost is through better material utilization. Probably one of the most interesting fields for the saving of material is in the cold extrusion of metal. Developments have made possible a tremendously broadened area of application. The basic advantages this process offers are numerous. The most important are:

- 1. Reduced material usage,
- Lower cost material—fewer extras hot rolled bar instead of cold drawn, tubing, etc.
- Improved physical properties—less carbon or alloy.
- 4. Reduces machining over hot forging.
- 5. Improved finishes—wear resistance.
- 6. Close tolerances,

The amount of engineering data currently available concerning the process



Spark plug assembly machine illustrates trend to automatic assembly.

makes it necessary that most new applications be handled on a development basis. In many cases, too, the investment of phosphating, annealing and press equipment is too great to be carried by the material savings from producing one part. Thus, the process may have to be studied and tooling developed for the production of a group of parts by this method before the equipment investment can be justified.

Another recent development which excites the imagination because of its potential industrial application is the use of metal adhesives. While they may not completely replace conventional joining processes such as brazing, soldering and welding, they should find wide application. Use of metal adhesives in the assembly of aluminum die castings, in the application of metal body trim and in many other manufacturing tasks will challenge the ingenuity of engineers for some time to come.

The direct conversion of steel machining chips into parts is another process which has been improved to the point where it has great potential for future material savings. Techniques have been developed which make this a relatively simple process and the continued rise in steel prices make the economics of the process even more favorable. The physical properties of parts so made closely approach those made from mill processed steel. While



Typical small parts produced by cold extrusion.



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this process may not provide for utilization of all steel machining chips, it does offer promise as another effective means of better material utilization.

Another area of great potential improvement which in the past has not been sufficiently recognized is that of material handling. The integration of equipment with simple material handling devices to provide continuous flow processing is being widely adopted



Sing made from compressed chips; (lower right) sectioned blank before machining and photomicrograph of cross section magnified 100 X.

where product uniformity will permit. Many modern plants are now abandoning the batch-type material handling concept in favor of the continuous flow concept and realizing important savings both in material handling costs and in process inventories.

Applications of electronics and related techniques are equally exciting. The measurement of vibration, or noise, in such items as ball bearings, gear trains, and electric motors has long been used as an indicator of quality. However, when done by humans, precise and repeatable standards cannot be established.

Another significant item is the use of ultrasonics, magnetic techniques, and radioactivity to inspect for flaws only found before by destructive tests.

It is significant that a great many of the newer processes must have their origin with the product engineer in that the product must be designed to suit. Thus, a knowledge of new processes and their possibilities is of great importance to product engineers. As products and the means of producing them become increasingly complex, the fields of interest of product and production engineers become closer related. A picture of what lies ahead in the other fields of specialization can be of valuable assistance to each group in doing tomorrow's job better.

From a paper given at the SAE National Production Meeting and Forum, Society of Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.





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# Industrial Engineers and Quality Control

By J. M. Juran

Consulting Management Engineer

A major industrial phenomenon of the 20th century has been the rise of the mass production of precision goods. Among the problems posed by this phenomenon has been the need for new tools for establishing and achieving quality standards.

Development of these new tools has proceeded unevenly. Some tools, notably statistical methods, are well developed. Other vital tools lag behind. This unbalance has contributed to inadequacies in solution of the new quality problems.

In proportion to his potentialities, the industrial engineer has to date made but little contribution to solving these problems. However, the nature of the solutions needed suggests that the industrial

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engineer should expand greatly his role in quality control. This expanded role would properly include activity in the following areas:

- 1. Clarification of quality control pol-
- Development of economic principles for balancing the cost of quality with the value of quality
- Development of optimum organization forms for handling the quality function
- Expansion of the concept of quality planning to include the entire progression of events from specification to usage
- Development of units of measure and of standards of performance for the quality function
- Development of means for measuring quality performance against goals
- Definition of the concept of qualitymindedness, and development of means for attaining quality-mindedness.

The explosive growth of mass production of precision goods suggests that nothing short of recognizing quality control as a major industrial engineering problem will suffice for adequate solution.

From paper given at National Conference of American Institute of Industrial Engineers, Inc., 145 N. High St., Columbus, Ohio.

# Nuclear Engineers Needed

By Glenn Murphy

Iowa State College Ames, Iowa

The time is rapidly approaching when it can no longer be assumed that national laboratories can give attention to formal training programs for nuclear engineers. The real responsibility and the major responsibility for nuclear engineering education must rest with the colleges and universities.

Within colleges, however, there should be no single program or pattern of development of courses. On the contrary, each institution is encouraged to experiment with arrangements and procedures that appear to be most fruitful in the light of local conditions.

The report of the Committee on Atomic Energy Education of ASEE states that today's vast number of nuclear activities should be matched with an equally vast number of educational programs involving the cooperation of colleges and universities, of government laboratories and of industry.

The key to progress in nuclear education lies in individual faculty members and their talents for educating and inspiring their students.

In charting educational courses of the future, three techniques are suggested for use in the nuclear science and engineering field. These would prepare students for six primary functions: control and handling of nuclear plants, processes and materials; management of industries in which nuclear techniques may be introduced effectively; design of processes, equipment and structures; creation of ideas, systems and designs for new applications of nuclear science; research to establish new data and formulate new principles; and teaching in colleges.

One training technique which colleges and institutes of technology may use is to incorporate appropriate nuclear data and laboratory work into the usual undergraduate courses in science and engineering. A course in engineering materials, for example, might include consideration of radiation damage on each of these materials. This is an extremely effective technique, but not widely applicable because engineering teachers generally could not be ex-

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

pected to teach nuclear engineering.

Modifying courses to make room for a connected study of nuclear energy is a second technique. Several periods in a conventional heat transfer course, for instance, might be given to study of reactor cooling systems.

The third technique is to develop new courses in nuclear energy and its applications. This will be more acceptable to the teachers and less welcome by the curriculum builders.

Most institutions developing programs in nuclear energy can use all three of these techniques advantageously, and experiments in all of them must be considered. Additional sequences are being developed at present on the graduate level.

From a report given at the 1957 annual meeting of the American Society for Engineering Education, Cornell University, Ithaca, N. Y.

# Engineering a Better Future

By H. Rowman Galther, Jr.

Chairman of the Board Ford Foundation and Rand Corp. New York City

Tomorrow's world will be a place where man will be able to control the climate and the weather; there will be limitless sources of energy, and electronic translating machines will simplify communications between nations.

The power of destruction inherent in nuclear energy, however, must be controlled if mankind's power to progress is to be exercised.

The social sciences, in coming years, will benefit by technological processes,

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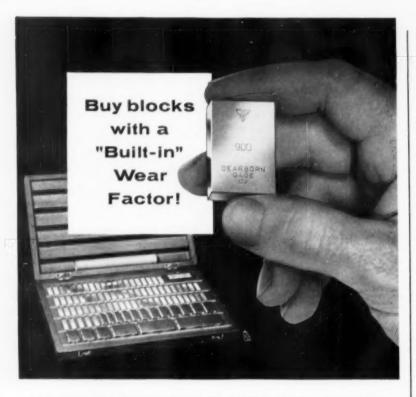
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# tech digests

and the computers themselves may be applied to problems of social science.

Man will someday be able to eliminate all known diseases, as well as others not yet recognized, world-wide television networks will be produced, and space travel will become a reality. There really is nothing Buck Rogers about any of this. What seemed improbable fantasy 25 years ago is today a commonplace. What is needed "constructive dreaming" by engineers.

Impressions gained during a recent trip through much of Asia, indicate the growing demand for a better life by Asian peoples. This is sometimes called Asian Nationalism, but is not just nationalism identified with national governments or national commitments. Rather, it is a universal ferment in the area. To meet needs of the future, engineers must apply more effectively the new technical knowledge being gained each day. There is a danger that in the under-developed countries, demands and expectations can outstrip available trained human resources and available natural resources. Disillusionment stemming from this can produce political chaos, leading to war.

From a talk given before the San Francisco Semiannual Meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

# New Stainless for High-Temp Uses

By George E. Linnert

Armeo Steel Corp. Baltimore, Maryland

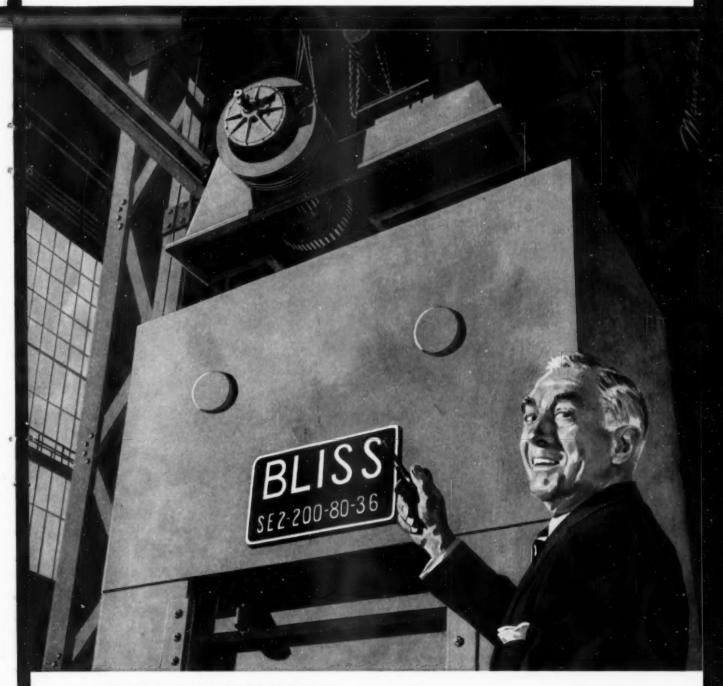
Precipitation hardening stainless steels are being used in increasing quantities in airframes for new aircraft and missiles.

Engineers and manufacturers have been giving much attention to these steels because of the relative ease with which they can be frabricated and treated to form high-strength corrosion-resisting structures.

The unique fabricating qualities and desirable final mechanical properties has even led to the use of precipitation hardening stainless steel in applications where corrosion resistance is of little or no importance.

When strength at elevated temperatures becomes a factor in airframe design, these steels are among the few materials that can qualify to meet service requirements.

From a paper given at the 1957 Engineering Management Conference, American Society of Mechanical Engineers, 29 West 39th St., New York, N.Y.



### "This used to take hours...

now the whole gearcase comes off in minutes!" Quite an accomplishment for an enclosed eccentric press. Too often the advantages of the enclosed design are gained by sacrificing the accessibility of the open design. Not so with Bliss, however: Bliss engineers count practical maintenance a design "must"—any new design that comes off the boards at Bliss keeps the maintenance man in mind.

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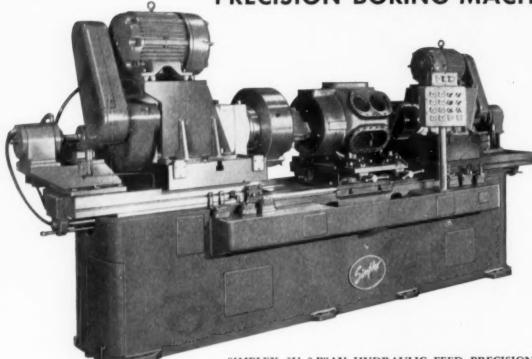
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25<sup>th</sup> YEAR

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NEW DIE SET CATALOG No. 11

is another reason the shop owner prefers Producto. It makes selection and ordering really easy. Write for your free copy today. And ask to receive Die Set Digest, too.



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October 1957

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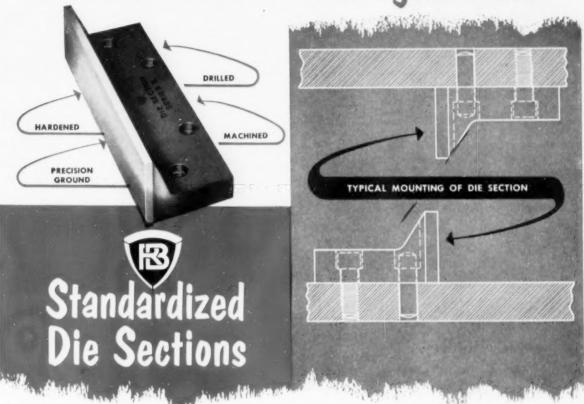
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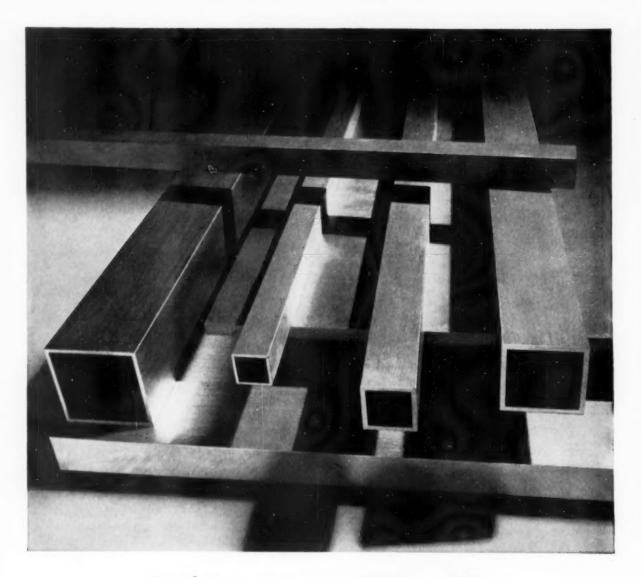
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DETROIT 39, MICHIGAN



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Square magnesium tubing combines light weight with strength, rigidity and dimensional stability. Used with magnesium tooling plate, it permits simplicity of design and construction of assembly jigs, testing fixtures and stands, movable platforms, dollies and many other tooling applications.

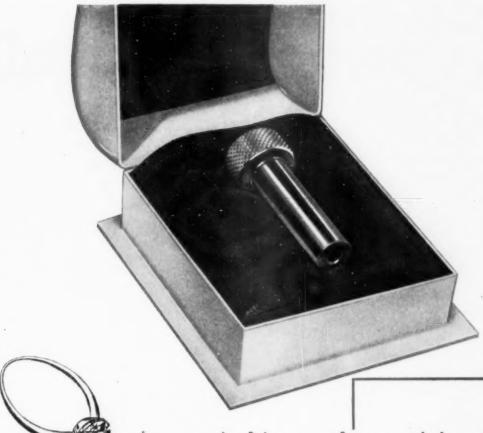
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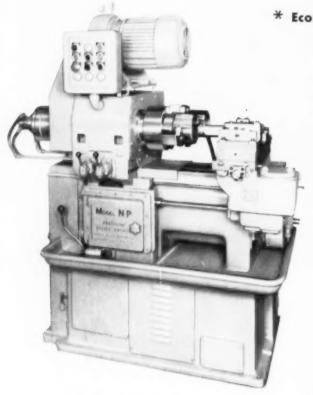
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# NEW MACHINE OF THE MONTH NEW ECONOMY IN PRECISION BORING



\* Economy in initial investment

Economy in machining costs

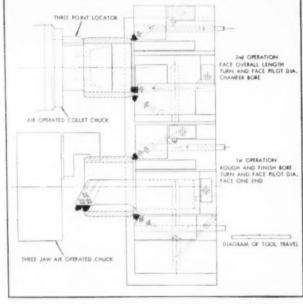
Economy in maintenance costs

Economy in change-over time

The new Seneca Falls Model "NP" Precision Boring Machine is a top quality, reasonably priced, mechanically operated machine available with either one or two precision spindles mounted independently on a fixed bridgé. Either the work or the tools can be rotated on the spindles. The patented "Quick Change-over Mechanism" permits variations in carriage stroke, rapid traverse and feed cycle without changing or purchasing additional cams and reduces average changeover time to less than thirty minutes. The design of the headstock bridge permits the installation of other makes of standardized boring heads.

Let our engineering staff help solve your precision machining problems.

The two-spindle machine illustrated above is equipped for boring, facing and rabbeting both ends of field rings in a single machine cycle. When the operator removes a finished piece from the rear chuck, he transfers a semi-finished piece from the front chuck and replaces it with a rough piece. When the starting button is pressed, the tools move forward in rapid traverse to cutting position, automatically shift to cutting feed, and finally return to starting position in rapid traverse. The entire operation is automatic. The field rings are 4-½" in diameter and a production of 60 pieces per hour at 100% efficiency is easily maintained. Tooling arrangement is illustrated opposite.





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SENECA FALLS, NEW YORK

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... the machine that produces deep holes 3 to 8 times faster

The manufacturers of this new concept in deep hole boring say that the Rapid Borer was developed expressly to accommodate revolutionary new tooling which drills, bores and trepans at high speed with accuracy, and gives excellent finish. Cutting oil is forced between the boring bar and wall of stock, forming a continuous bearing. The oil is forced back through a hollow boring bar, carrying away the chips as it goes. Tool faces are kept clean and chip passage clear. Chips do not come in contact with finished bore.

To insure the success of this operation, a special cutting oil with extreme pressure and excellent cooling characteristics was required. Shell Research went to work, and out came a new addition to the Shell family of cutting oils . . . Garia® Oil 115.

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# SHELL GARIA OIL 115



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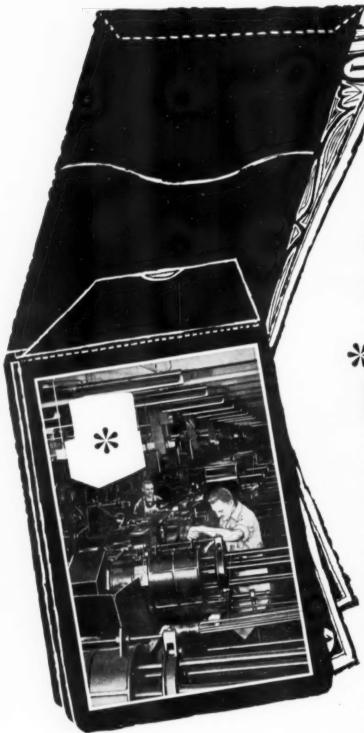
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TORRINGTON ROTARY SWAGING MACHINES

# 50 lbs. oil pressure

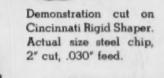
IS NECESSARY WITH A CUT LIKE THIS...

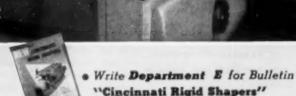
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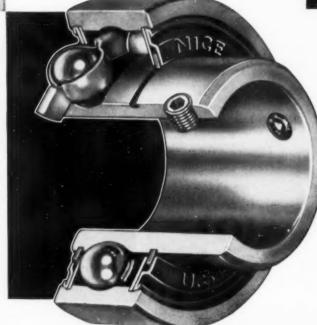
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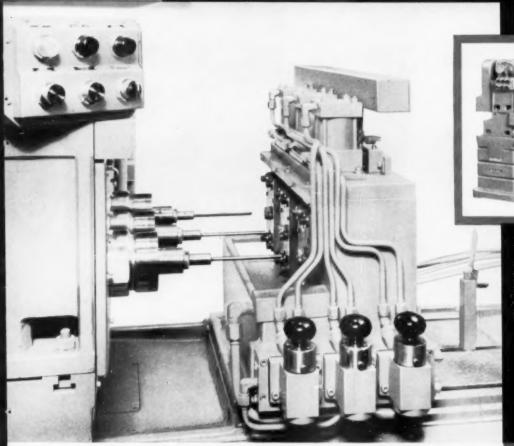
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NICE is the word for BEARINGS

NICE BALL BEARING COMPANY





A standard Style 112-D Precision **Boring Machine** equipped for Bor-Dril work.

Bor-Drilling on a standard 112-D Precision Boring Machine. This three-station set-up produces closetolerance holes, smooth finish.

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THE PROBLEM: an auto manufacturer wanted to produce accurate, closetolerance holes from the solid in small transmission parts without costly secondary operations.

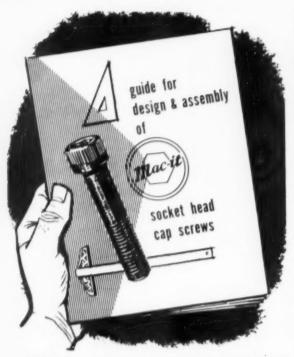
THE SOLUTION: Ex-Cell-O Style 112-D Precision Boring Machines equipped for Bor-Drilling. These machines are Bor-Drilling .312"-.313" diameter through holes for a distance of 21/2", three at a time in transmission range selector shaft. WHAT IS BOR-DRILLING? Bor-Dril is a new way of driving gun drills, adapted to high production-with-accuracy requirements. Bor-Drilling is especially effective when machining from the solid holes too long for single-tool boring applications, and holes in which it is difficult to maintain finish size. Bor-Drilling requires no secondary finishing operations in most cases. Ask your Ex-Cell-O Representative or write Ex-Cell-O, Detroit for Bulletin 311162 explaining all about Bor-Drilling.

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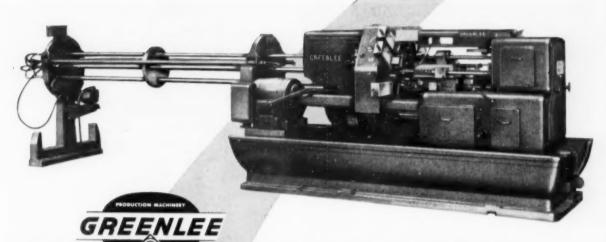
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The Tool Engineer



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Problem: Long, counterbalanced air plug gage on hoist had to be centered and inserted through camshaft bores by the operator. Another air plug gage was required for crankshaft bores, while another gaging method was used for checking presence of oil holes. Although gaging was accurate, the operation was inefficient and tiring for the operator.

Solution: Taft-Peirce developed this 26-dial Comp-AIRamatic that simultaneously indicates: 1. 5 cam bore diameters in two planes within .0015" total tolerance. 2. 5 crank bore diameters in two planes within .002" total tolerance. 3. Cam counterbore within .0005" total tolerance. 4. Presence of oil hole reservoir in 5 cam bores (using patented Taft-Peirce Comp-Utair Air Gaging Circuit).

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JACOBSEN MFG. CO. combines readily available Standard Dumore Components with simple fixturing and indexing to quickly build this special-purpose machine for faster, lower cost production on brass connecting rods.

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THE DUMORE SERIES 28 "DRILL-N-TAP" UNIT drills or taps at the flip of a switch. Tap fits into chuck, no extra head required. Reversing motor removes tap, eliminates expensive clutches. Spindle speeds 265 to 4900 rpm. For long or short runs. Mounts in 3 minutes - anywhere, with simple nose bracket. Available as complete Drilling and Tapping Press with fixture, press and "Drill-N-Tap" Unit, or, "Drill-N-Tap" Unit supplied with bracket to convert your 14" x 17" drill press into a completely automatic drilling and tapping machine.

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AND BRACKETS Provide mounting for Dumore Units on your 14" x 17" drill press

FOR MORE INFORMATION ON THESE PRECISION TOOLS-WRITE FOR CATALOG



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# Bata cuts mold cleaning time in half with Pangborn Hydro-Finish

Bata Shoe Co., Belcamp, Md., used to clean shoe molds by pickling. For a better cleaning job, Bata replaced this process a year ago with Pangborn Hydro-Finish. Today this machine gives Bata top quality cleaning, does the job in half the time required by pickling and has required "no maintenance whatsoever." Also, acid disposal problems have been eliminated.

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Today, through new design and use of air jet sluriators, Pangborn Hydro-Finish costs less originally, costs less to maintain and gives you easier handling and added efficiency. Write for Bulletin 1403 to PANG-BORN CORP., 4700 Pangborn Blvd., Hagerstown, Md. Mfrs. of Blast Cleaning and Dust Control Equipment.

USE PANGBORN HYDRO-FINISH FOR:

Deburring · Surface finishing · Finishing threaded sections · Improving cutting tool life . Maintaining dies and molds . Removing grinding lines • Removing heat treat scale • Preparing surfaces for coatings, platings, etc.

Pangborn

BLAST CLEANS CHEAPER

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-234-1



accurately made, .ust-

proofed and priced at

much less than your own

shop could make them.

ADJUSTABLE A



strength is needed no accurate machining of frame



For contour boards between unparallel surfaces

WRITE OR WIRE FOR CATALOG No. 5



For quick removal of Contour boards between unparallel surfaces

9244 Shortridge Saint Louis 19, Mo. USE READER SERVICE CARD; INDICATE A-10-234-2



Hoggson Brand Reverse Stamps are designed for stamping molds for making rubber, plastic and glass products and for marking die sinking molds and forming dies.

Made of high alloy steel, specially heat treated to withstand continuous impact, they are made for marking flat or contoured surfaces, and are GUARANTEED ACCURATE.

Available from stock in letters and figures from 1/4" to 1/4", Hoggson Brand Reverse Stamps are also supplied, hand cut to your order, as symbols, trademarks, or other special designs.

Specify Hoggson Brand Reverse Stamps. They're a step in the right

HOGGSON & PETTIS 144 Browery Street



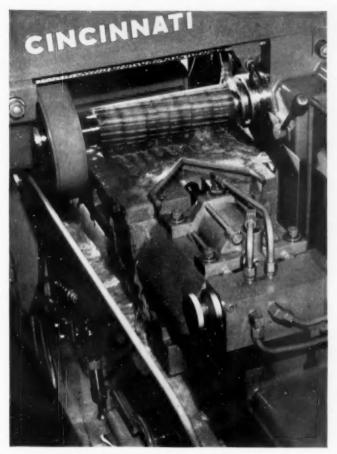
MANUFACTURING CO.

USE READER SERVICE CARD, INDICATE A-10-234-3

# POHERMATIG

# Lives Up To Its Name

# Takes 141/2" Wide Cut in One Pass



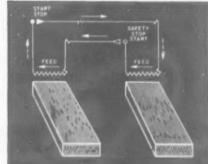
The Powermatic automatic cycle diagramed at the right combines high production with high quality to mill the teeth in 3700 hack saw blades per hour.

Combining a high percentage of usable power with automatic cycles is the specialty of Powermatic Milling Machines. The one illustrated here does the job to perfection for a prominent manufacturer of saw blades . . . it takes a 10½" to 14½" wide cut in one pass, over two banks of parts, with automatic cycling of the table and spindle carrier. ¶ This Powermatic is a plain automatic rise and fall style, 36" table traverse. Two hydraulic clamping fixtures with safety interlock, each holding 288 parts, are mounted on the table. The machine takes a "climb-milling" cut over both banks of parts, a distinct advantage in producing a uniform finish.

# 3700 saw blades are milled per hour at 87% operator efficiency

You will be interested in what makes this Power-matic setup a low-cost producer for similar work in your shop. Standard features include automatic backlash eliminator; automatic spindle stop; Dynapoise overarm; cycle selectors for automatic cycles. And Cincinnati engineering service is assurance of the most economical production of your components. Would you like to know more about CINCINNATI® Powermatic Milling Machines? You will find brief specifications in Sweet's Machine Tool File. For complete data, write for catalog No. M-1913-1.

# THE CINCINNATI MILLING MACHINE CO. CINCINNATI 9, OHIO







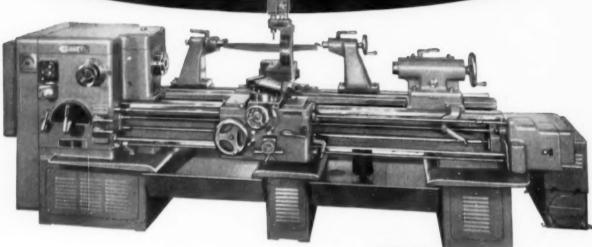
# CINCINNATI

MILLING MACHINES - BROACHING MACHINES - CUTTER AND TOOL GRINDERS - SPECIAL MACHINE TOOLS - METAL FORMING MACHINES HARDENING MACHINES - CUTTING FLUID - GRINDING WHEELS

# for Limited or Large Production...

# SIDNEY DIAL-MA

MODEL 32 *DIAL-MASTER* WITH FLUID TRACER



On small or limited production these lathes give you an infinitely precise cutting job... on large or extended runs the SIDNEY FLUID TRACER just keeps on and on turning as many pieces as you need (the sky is the limit) with uniform precision, speed and economy.

Change-over to standard lathe operation or back to tracer work requires just a few seconds without adding or removing any parts.

Note This: The Sidney Dial-Master with Fluid Tracer produces 300% more work than any other lathe with Corresponding savings in time and cost per piece

30 or more hydraulically controlled pre-selective spindle speeds . . . simple . . . versatile . . . accurate

Write for new bulletin or ask for representative to call at your convenience.





Single lever control carriage and apron For both standard longitudinal and crossfeed as well as 4-way rapid traverse. Built-in thread chasing dial is convenient to operator's vision.



Shift to any speed in only 2 seconds
Smooth — swift — sure! Change in speeds is
AUTOMATIC by hydraulically actuated shifter
mechanism with the engagement of the control
lever.



# This is the scrap pile for a run of 400 Class 5 tolerance screws

Four minutes' worth of on-the-spot inspection on a Kodak Contour Projector tells operators how five critical tolerances of their work measure with company standards. Result—a reject rate of ¼ of 1 per cent.

The Chicago Screw Company, Division of Standard Screw Company, produces threads to Class 3, 4, and 5 tolerances—fine or better—for automotive, aircraft, and farm machinery makers.

Screws have tolerances of .005" lead error to fit a .002" dimensional tolerance gauge; .002" pitch diameter tolerance; and 15-minute tolerances on flank pitch.

Kodak Contour Projectors make it easy for operators to run rapid routine quality checks. Highly trained inspectors check operators' quality control reports and spot-check production.

When a tolerance question comes up, the accurate

answer again comes from a Kodak Contour Projector. In about four minutes, operators check out a thread completely, including pitch diameter, lead error, pitch, depth, and helix angle to tolerances well within .001". As a result, the reject rate in the firm's threading division is down to an average of ¼ of 1 per cent.

A Kodak Contour Projector can be the way for

you to keep tolerances profitably tight on mass production runs. It can also be the way for you to improve inspection accuracy and speed—while lowering your inspection costs. Send for the booklet "Projection Gaging with Kodak Contour Projectors." Write to:



Kodak Contour Projector, Model 14-2A—a versatile, precision measuring projector for toolroom or production line.

Apparatus and Optical Division

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak



# NEEDLE BEARING ASSEMBLIES



# REHNBERG-JACOBSON



# NEEDLE BEARING ASSEMBLY MACHINES

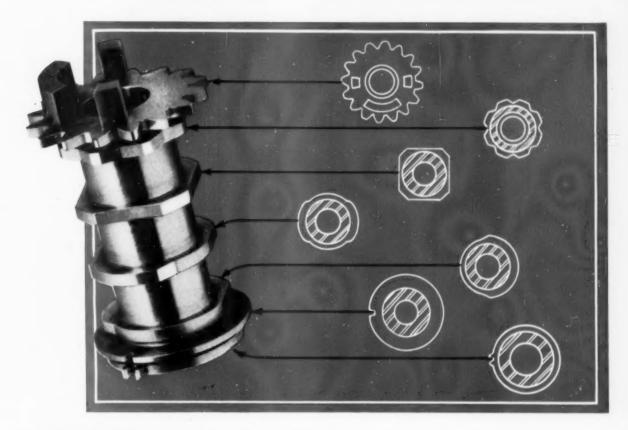
**PURPOSE:** To assemble the "needles" into their cup, bushing, hub, hole, or housing — and to do this automatically at high production rates. Also, to add, when required, a shot of grease, a pressed-in retaining cup, a snapped-on rubber grommet, or a dummy plug.

ACCOMPLISHMENT: The desired result, in a vast variety of applications, as shown by just a few examples above. A typical 3-hopper full-automatic machine is shown at the left.

NOTE: For many years we have been outstandingly successful in producing these highly-specialized machines. This is your assurance of satisfying performance.

REHNBERG-JACOBSON MANUFACTURING CO. 2135 KISHWAUKEE ST., ROCKFORD, ILL.

DESIGNING ENGINEERS, MANUFACTURERS, AND PRODUCTION CONSULTANTS



# **DESIGN** for Lower Cost

In many instances, designing for production on a Fellows Gear Shaper offers exceptional opportunities to lower costs, on non-involute shapes as well as gears. This is particularly true where gear shaper versatility makes it possible to generate multiple parts on the same shaft, thus eliminating assembly operations and simplifying design.

The unusual multiple cam and gear part shown is an example. The gear and various cams are positioned to within 0.001" alignment. Since there were no keyways or other machining required for assembly, there was a considerable reduction in production time, in addition to the time saved because of the high cutting speed of the gear shaper. Finally, the integral design resulted in a saving in weight without loss of strength.



These and other advantages of the method are described and illustrated in the booklet, "The Art of Generating with a Reciprocating Tool." This booklet, although not new, contains a lot of information that is valuable to designers concerned with generated shapes. Since 1951 we have distributed over 10,000 copies. If you would like one, just write us.

THE FELLOWS GEAR SHAPER COMPANY

78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Michigan
150 West Pleasant Ave., Maywood, N. J.
5835 West North Ave., Chicago 39
6214 West Manchester Ave., Los Angeles 45

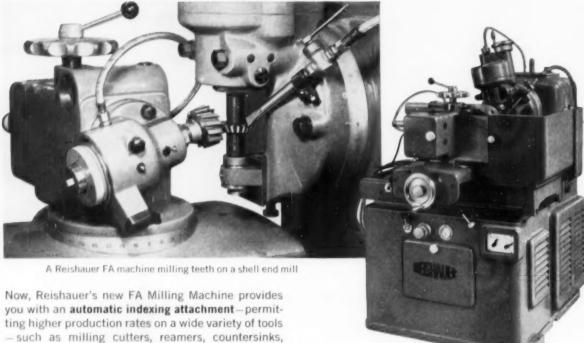
THE PRECISION

Cours Gear Production Equipment

# Automatic Indexing For Milling

# **All Types of Cutting Tools**

with a REISHAUER FA Milling Machine



The Reishauer FA Milling Machine

Now, Reishauer's new FA Milling Machine provides you with an automatic indexing attachment—permitting higher production rates on a wide variety of tools—such as milling cutters, reamers, countersinks, index plates and others. Universally adjustable, this Swiss-made machine can produce (1) teeth on end or circumferential surfaces, or (2) straight or helical flutes on cylindrical or tapered workpieces. It is ideal for workpieces that require dividing operations. As index plates Reishauer uses its own, world-famous ground gears—guaranteeing extreme indexing accuracy.

All movements on the Reishauer FA – longitudinal slide, rapid adjustment device, cross-slide clamping and indexing—are electro-hydraulically operated. By means of the automatic indexing device, all working operations, return strokes and dividing movements follow each other in pre-determined sequence and increments, until the workpiece has made a complete rotation. Complete coordination and interlocking of all movements prevents any possible working errors. Index plates for irregular divisions are also available.

### SPECIFICATIONS

Workpiece Diameters ½" to 6¼"	
Milling Cutter Diameters 1%" to 41/4"	
Milling Spindle Speeds 63 – 400 rpm	
Maximum Clamping Length 9"	
Stroke of Longitudinal Slide	
Milling Spindle Adjustment from	
vertical axis±30°	
Horizontal Workpiece Adjustment to 90°	
Vertical Workpiece Adjustment ±45°	
Possible Indexings	

Write For Additional Information

COSA

 nationwide sales and service of precision machine tools from bench lathes to boring mills.

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

IN CANADA contact COSA CORPORATION OF CANADA, 1160 Lakeshore Road, Long Branch, Toronto 14, Ontario



# JESSOP STEEL COMPANY • WASHINGTON, PA.

OFFICES IN PRINCIPAL CITIES

Jessop Steel of Canada Limited, Wallaceburg, Toronto Jessop Steel International Corp., Chrysler Building, New York, New York immediately impressed with the clean, quiet lab-like atmosphere, the intensity of effort and care that personifies true craftsmanship. For here Jessop processes fine Truform oil or Windsor air hardening tool steel into one of its top products . . . precision ground flat stock used for the production of highly accurate dies, gages, cutters, machine parts, straight edges or the like. This Jessop product comes as close to perfection as the steelmaker's art logically allows. Each piece, of any size, is highly-finished, dead flat and square, and guaranteed to have a thickness tolerance of plus or minus .001 and a width tolerance of plus .005, minus .000. An inspector double checks the analysis with a delicate Magnetic Analysis Production Comparator and a Profilometer is used for inspection of the finish. After all tests are passed, the stock is carefully wrapped for shipment to Jessop customers all over the world. If you have any application for this type of product, it will pay you to send in an inquiry. Jessop's pride of accomplishment will make it a better buy for you.

# EXTRA DRILLING CAPACITY FOR YOUR TOOLROOM

# LELAND-GIFFORD NO. 3 MVB TOOLROOM DRILL PRESS

A companion machine to the widely used Leland-Gifford No. 2 LMS Toolroom Drill Press - providing extra capacity with comparable features and conveniences. This machine is always available to help with heavy-duty production work while handling the general run of toolroom drilling and tapping with effortless speed and ease.

### check these features

- √ Speeds from 33 to 1.800 RPM.
- √ Capacity of No. 3 Morse Taper.
- √ Extra large 40½" x 23½" or standard 241/2" x 231/2" tee-slotted table.
- √ 24" swing with 12" overhang. Geared power feed with feed rates of .006" - .012" - .018" per revolution.
- √ Illuminated indicating shift with cutting speed chart.
- √ Conveniently located hand wheel for changing spindle speeds and shifting back gears without stopping machine.
- √ Positive stop for accurate depth adjustment.
- √ Foot switch start-stop motor control.
- √ Counterbalanced sliding head.
- √ Built-in light for table and work illumination.



# LELAND-GIFFORD

**Drilling Machines** 

WORCESTER 1, MASSACHUSETTS, U.S.A.

CHICAGO 5

CLEVELAND 22

DETROIT 21

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### Branch Offices:

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NEW YORK

ROCHESTER 12



This electric-iron aluminum sole plate is being polished by an "81-Coat" Resinall Metalite Belt, grit 24X. F ishing time has been slashed and belt life greatly extended since these new Behr-Manning belts went on the jo

# New "SPUR-ACTION" abrasive belt cuts faster, outlasts all others by as much as 50%

New "81-Coat" abrasive belts and discs have hundreds of sharper, tougher "spur" points per square inch for fastest stock removal... for greater resistance to grinding heat, the strongest resin bond yet. Test them yourself. Write for a demonstration of "81-Coat" abrasives on your toughest job—at your plant or at our nearest Branch Methods Room. You'll see how you can spur more production, more mileage per belt—and at no increase in price!

## BEHR-MANNING CO.

TROY, N. Y.

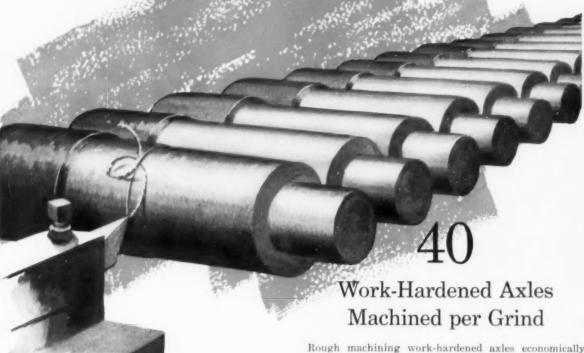
DIVISION OF NORTON COMPANY

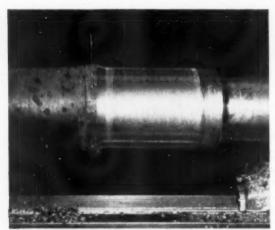
HORTON

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories (a Canada, Behr-Manning (Canada) Ltd., Brantford. For Export: Norton Behr-Manning Overseas Inc., Troy, N. Y., U.S.A.



HAYNES Alloys solve the tough machining problems





HAYNES STELLITE 98M2 tools make a 5/16 to 3/8 in. deep cut on this work-hardened axle. They cut through alternate hard and soft spots of the work-hardened surface. The area machined on each axle is approximately 12 in. wide.

Rough machining work-hardened axles economically proved to be quite a problem until HAYNES STELLITE alloy 98M2 tools went into action. Previously used tools wore quickly and had to be replaced after machining only a few of the SAE 1040 steel parts. The HAYNES STELLITE alloy tools machine 40 axles between grinds and remain in operation for an entire week. During the machining operation the 98M2 alloy tools cut through both hard and soft spots of the work-hardened surface.

If you have a machining operation that requires a rugged tool alloy that retains its hardness at red heat, can make deep cuts at relatively high speeds, and resists chipping under adverse machining conditions, it will pay you to investigate the complete line of

For complete information, write HAYNES STELLITE COMPANY, Division of Union Carbide Corporation, Kokomo, Indiana. Or contact our nearest sales office . . . Chicago, Cleveland, Detroit, Houston, Los Angeles, New York, and San Francisco.

HAYNES STELLITE alloy cutting tools.



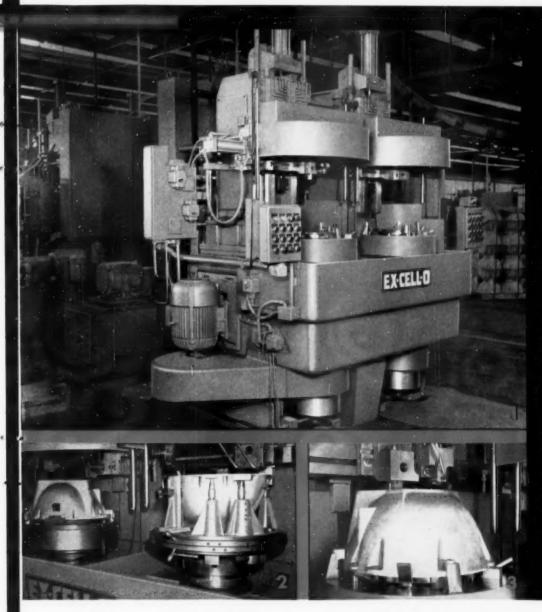
# HAYNES

HAYNES STELLITE COMPANY

Division of Union Carbide Corporation Kokomo, Indiana



The terms "Haynes," "Haynes Stellite" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.





EX-CELL-O FOR PRECISION

- An overall view of the Ex-Cell-O Style 432 Duplex Vertical Machine, used for finish facing, boring and chamfering automatic transmission housings.
- These are stations #1 and #2 of the first of the three Style 432 machines. Part at left is semi-finish faced, while part at right is finished on the opposite end by two tools each making one pass.
- 3 Close-up of housing during the finish face, bore and chamfer operations. Housings are permanent mold aluminum casting.

57-71

# Want Higher Production ...?

Here's how one auto manufacturer did it

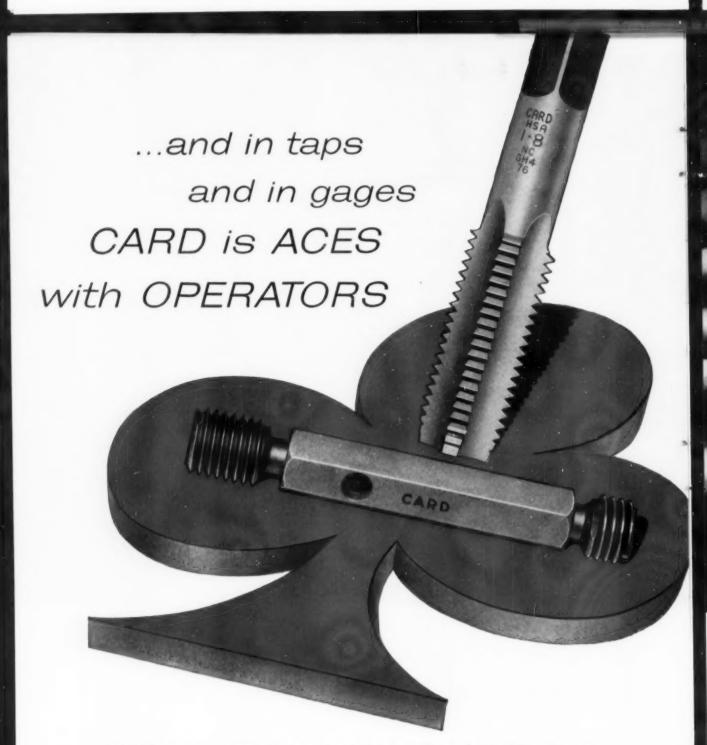
Urged by the upswing in automatic transmission demand, one of the "Big Three" installed several Ex-Cell-O Duplex Vertical Boring Machines. The two-station units rough and finish permanent mold aluminum torque converter housings at a rate of 164 per hour! Automatically, of course. Operations performed by this Style 432: turning, boring, facing, grooving and chamfering, alone, or in any combination.

Perhaps you have a volume production operation you would like to double at no increase in per-unit cost? Then you'll want to find out all about Ex-Cell-O Vertical Boring Machines. Their two-station construction auto-

matically doubles operator output. Get in touch with your local Ex-Cell-O Representative soon. Or, if you prefer, write direct to Ex-Cell-O, Detroit.



MAMUFACTURERS OF PRECISION MACHINE TOOLS . GRINDING AND BORING SPINDLES CUTTING TOOLS . TORQUE ACTUATORS . RAILROAD PINS AND BUSHINGS . DRILL JIG BUSHINGS . AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS . DAIRY EQUIPMENT



"Card taps and gages are action-mated to the job," are the words actual operators use to describe why they are precise and accurate. Tool after tool . . . shipment after shipment . . . the Card Product is exactly what the operator expected it to be. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

# CARD

DIVISION OF UNION TWIST DRILL COMPANY

- Serving you through fine distributors from Coast to Coast

If you use twist drills as fast as some folks chain smoke...

This brand cuts down your drill usage, production time and costs!



# The more twist drills you use, the more you need Union

Union also manufactures milling cutters, gear cutters, hobs, reamers and carbide tools. Available nationally through Union warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco. S. W. CARD DIVISION, Mansfield, Mass.; BUTTERFIELD DIVISION, Derby Line, Vt.

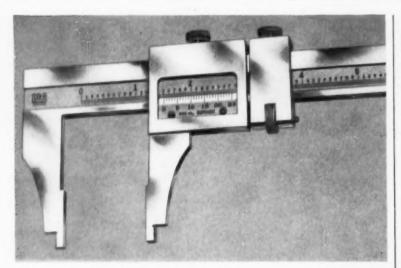
# UNION

TWIST DRILL COMPANY, Athol, Massachusetts
See Your UNION DISTRIBUTOR for cutting tools that will save you time and money

# Precision Tool News

B·S

REPORTING NEW DEVELOPMENTS AT BROWN & SHARPE'S PRECISION CENTER



### Users Find Double-length Vernier Plate Just Right For Easy, Accurate Reading

In the few months that the Brown & Sharpe Super-Vernier Caliper has been on the market, it has created much enthusiasm among users. The new vernier plate is twice as long, making it twice as easy to align and read, Only a fraction of an inch has been added to the over-all length of the caliper in order to accommodate

the longer vernier plate; consequently the easy-to-read advantage has been gained without sacrificing the goodhandling qualities of the tool.

Another aid to easy reading is the reflection-free dull-chrome background, against which the jet black, machinecut graduations stand out in sharp contrast.



### **B&S** Intrimik Measures Hole Diameters Directly

Intrimik ("In-tri-mike") is a selfaligning, internal, tri-point micrometer that measures directly the LD. of any hole within its range. It is more economical for measuring bores and holes of varied sizes than comparators or plug gages; and in production, where all holes are held to a close tolerance, it saves expense by showing the exact amount of metal still to be removed. Intrimiks are available individually or in five sets, to cover from .275" to 8.000". Sets are furnished in cases with calibrating rings, and with extensions which permit accurate measurements at depths to 15".

### Brown & Sharpe Announces Precision Sine Plate at Low Price of \$110

Brown & Sharpe offers this accurate, versatile new tool providing precision angular settings at a new low cost. The B&S Precision Sine Plate, No. 925, is made of case hardened and aged normalized steel . . . with a beautifully fitted hinge and glass-smooth finish. Machined and assembled to an over-all accuracy within .0002", it assures highly precise angular measurements when set to gage blocks. The working surface of the hinged plate is 3½" x 6"; distance between roll centers, 5". No. 925 has an end plate and plenty of tapped holes for special clamps or other holding devices.





Another new B&S tool, No. 624 Planer and Shaper Gage, is the most accurate gage of its kind for tool setting.

### Your Local Distributor Has These B&S Tools In Stock

For your convenience, Brown & Sharpe Precision Tools are stocked by leading distributors everywhere. Ask your local Brown & Sharpe distributor to show you these products, or write for additional information to Brown & Sharpe Mfg. Co., Providence, R. I.

WATCH WHAT'S HAPPENING AT

Brown & Sharpe

B·S

PRECISION TOOLS AND GAGES . MILLING, GRINDING AND SCREW MACHINES . CUTTERS . MACHINE TOOL ACCESSORIES . GEAR, VANE AND CENTRIFUGAL PUMPS

# INDUSTRY REPORTS ON





# "W-T Drill Presses are our first choice for efficiency and dependability—eliminate costly handling and changing of tools"...

reports Production Division, Hycon Manufacturing Co., Pasadena, Cal.



Production Manager Murray is given data on new Walker-Turner radial drill press line by Mr. Kirkham of Marshall Tool, W-I distributor in Southern California.

In commenting on his company's experience with Walker-Turner drill presses, R. D. Murray, production manager, has this to say about the 30 units in use at Hycon's Production Division:

"Walker-Turner multiple-spindle drill presses are ideally suited to our operations, and we've found they reduce machining costs. One operator can do drilling, reaming and tapping in the same work area without costly handling and changing of tools. And our lead men prefer to set-up jobs on them."

Also, Murray points out that maintenance on Walker-Turner "Light-Heavyweights" is very low and initial cost of the tools can be amortized in a relatively short time, with the machines still in good working condition.

Like this well-known, progressive manufacturer of electronic equipment, thousands of companies have found that Walker-Turner tools can't be beat for precision operation or economy. Your W-T distributor will be glad to demonstrate why. He's listed under "Tools" in your classified telephone directory.

walker	Division of Rockwell M. Dept. WK-25, 400 N. Le Please send nam Please send liter Name			
1	Address			
1	City	Zone	State	



# NOW

the latest technical advance in tools...

# "Job Tempered"

HAND and POWER

# Hack Saws

Certified by American Standards Testing Bureau\* to meet their standards for superior cutting — Uniform Teeth . . . Uniform Set . . . Uniform Temper

# FROM HEILET

Now you can cut all kinds of metal faster and cheaper . . . with hand or power hack saws . . . thanks to Heller's great new advance in tool technology — JOB TEMPERING.

Controlled-analysis steel is specially selected to strict Heller specifications, then Heller uses its own *unique* heat treating method to bring every blade to the precise hardness and temper to accomplish the class of work for which it is intended.

The result: Job tempered hand and power hack saw blades perform better and last longer on the toughest cutting jobs.

Based on this new development, every Heller blade is certified by American Standards Testing Bureau\* to meet the three vital requirements for superior metal cutting — Uniform Teeth, Uniform Set and Uniform Temper.

You can choose the right Job TEMPERED Blade from Heller's complete line. And if your sawing problem involves economy as well as the proper use of power hack saw blades, a HELOMETER will help prolong blade life, improve cutting and speed set-ups by showing you when blade tension is precisely correct.



# Big Benefits in the Heller Line of "Job Tempered" Hack Saw Blades

#### GIVE US YOUR TOUGHEST HACK SAWING PROBLEMS

We'll show you how the right Heller Job Tempered Blade can solve it efficiently and economically — delivering faster, smoother, trouble-free cutting over longer periods than ever before.

#### HERE ARE THE FACTS!

New Heller Hack Saw Catalog gives full information on sizes and types offered...shows why Heller JOB TEMPERED Blades, backed by the American Standards Testing Bureau\*, are best in job performance.

> WRITE FOR YOUR COPY TODAY.









HELLER TOOL CO.

America's oldest file manufacturer

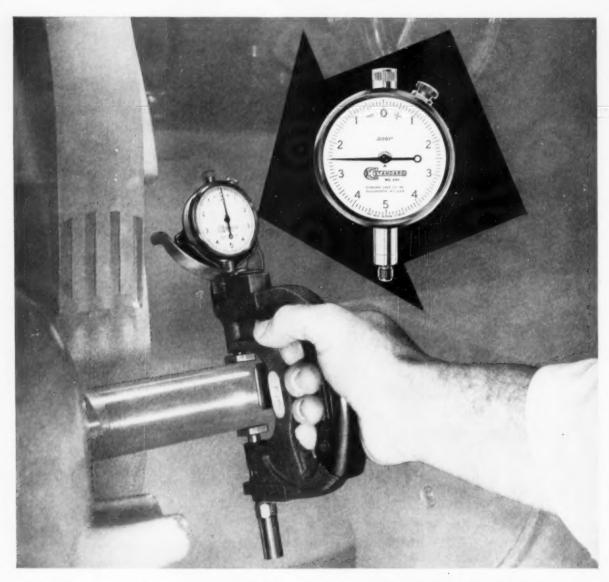
Newcomerstown, Ohio A subsidiary of Simonds Saw and Steel Co.











# Back of Every STANDARD Dial Snap is the Famous STANDARD Dial Indicator

A dial snap gage is only as good as its dial indicator. That is just one reason why STANDARD Dial Snap Gages are so widely preferred. STANDARD brings you the most complete line of Dial Snaps available. Models for every job . . . many with

exclusive PARALLOC® features to assure continuing parallelism even after repeated adjustments. High accuracy distinguishes them, as well as first-cost and cost-in-use considerations.

Ask the Man from Standard or Write Direct for Special Dial Snap Bulletin

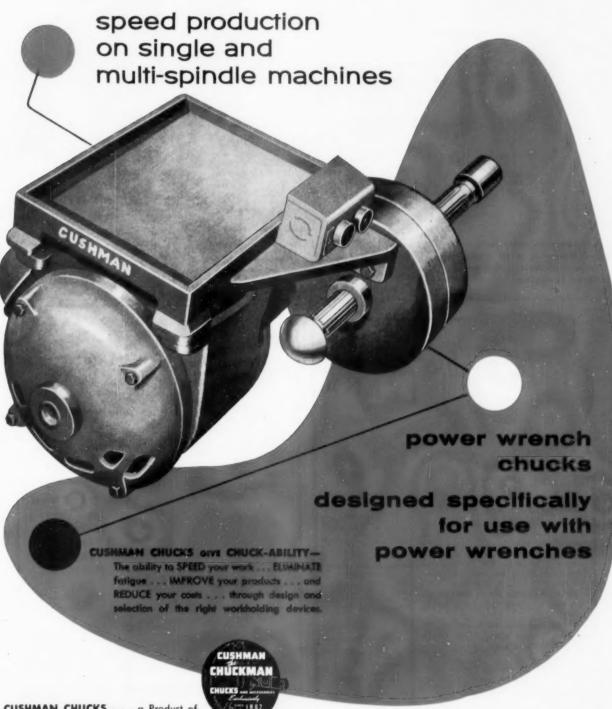


DARD GAGE COMPANY, INC.

POUGHKEEPSIE, N.Y.

A COMPLETE LINE OF GAGES . . . INDICATING, FIXED AND ADJUSTABLE TYPES

# CUSHMAN POWER WRENCHES



CUSHMAN CHUCKS . . . a Product of American Quality, Labor and Materials. Sold Through Your Industrial Distributor.

THE CUSHMAN CHUCK COMPANY Hartford 2, Connecticut

# **COMBINATION CUTS** GRINDING and INSPECTION COSTS!



#### COVEL NO. 10 SURFACE GRINDER Power or Hand Feed

Work Capacity—6" x 18" x 15" Grinding Wheel—7" x ½" x 1½"

This Covel machine offers a big value at a low price. Gives you these big machine performance

- Elevating, traverse feed, and table feed hand wheels grouped at convenient waist level posi-
- · Hard chrome table ways.
- · Smooth timing belt table drive.
- · Precision hardened and ground vertical and traverse feed
- · Extra engineered weight.

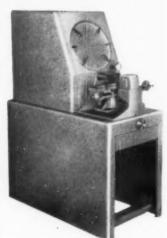
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#### COVEL NO. 14 OPTICAL COMPARATOR

Only \$985.00

For fast, accurate optical inspection

Add modern, efficient optical gaging and inspection at a price you can afford. Outmodes me-chanical checking methods, prevents costly errors, saves time and money. The Covel Optical Comparator is easy to use. Grindina machine operator can be quickly trained to check his own work right on the job. Large 14" diameter screen is easy to read in fully lighted room. Horizontal stage travel 6". Rugged, precision construction through



Write for Bulletin TE-107-14

Covel offers the widest choice in Surface Grinders up to 14" x 24". Cutter and Tool Grinders. Drill Grinders. Optical Comparators.



Benton Harbor, Michigan

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-254-1



#### Satisfaction Guaranteed Or Money Back TRIAL OFFER

MON Fittings are guaranteed to seal pipe thread connections permanently against all oils, practically all known chemicals and gases; to seal under high pressures or vacuum; to withstand -280" to plus 500" F.; to eliminate "overtightening" damage and pipe dope.

Available in 1/4" to 21/2" pipe thread sizes.

\$10.00 Trial Offer No. 1: eight 1/8", ten 1/4", eight 1/4", ten 1/4" pipe thread Im O III. Fittings

\$10.00 Trial Offer No. 2: eight 1/2", ten 1/4", four 1" pipe thread 16 0116 Fittings, Send order to

> TAU (6) SEAL DIVISION Flick Reedy Corp

2010 N. Hawthorne, Melrose Park, III.

USE READER SERVICE CARD: INDICATE A-10-254-2

'Miller Fluid Power'' Is also a Biv. of Flick-Reedy Corp.

Thread 014 en pipe or fitting (no messy pipe









.0002 T.I.R. or less at Spindle Nose, .0005 T.I.R. or less on Test Arbor six inches from Spindle Nose



K. O. Lee Company, Aberdeen, S. D.

USE READER SERVICE CARD; INDICATE A-10-254-3



ALLEN Engineers will show you how you can save time and money by using standard\* ALLEN Hex-Socket Cap and Set Screws instead of specials.

Let's get this straight right away...if your product design MUST have special cap or set screws, then ALLEN's the place to come for them.

But our engineers have found, from a good many years of experience, that designs frequently call for *special* hex-socket cap and set screws that are only slightly "off-standard." These specials take longer to get, cost more.

Allen engineers can probably save you both time and money by working with you on ways to use standard Allen Hex-Socket Cap and Set Screws, where specials may seem to be necessary. Just send blue prints, or good descriptions, of your product designs to our Engineering Department, or talk with your Allen Field Representative.

\*ALLEN manufactures 1457 standard items

Stocked and sold by leading industrial distributors everywhere

ALLEN

MANUFACTURING COMPANY Hartford 2, Connecticut, U.S.A.



# SIMONDS SERVICE

the Extra Value
behind Every
SIMONDS
Segmental Saw!

Sure you get straighter cutting, smoother finish and greater satisfaction when you select Simonds Segmental Saws — with your choice of tongued or slotted segments. But you get a lot more!

You get fast, dependable service at Simonds Factory Branches from skilled Simonds servicemen who really know their business.

In Sharpening — Newest automatic sharpening machines operated by men who have an instinctive "feel" for the proper cutting edge combine to put "new life" in your favorite saws.

In Repairing — Specially designed equipment handles flattening, straightening, tensioning, riveting, and finish grinding.

In Re-segmenting — Specialists using the latest techniques and machines have the know-how to do any re-segmenting job quickly to your complete satisfaction.

For complete Segmental Saw Service send your saws to any of these Simonds Factory Branches: 1350 Columbia Road, Boston, Mass. • 3323 West Addison St., Chicago, Ill. • 228 First St., San Francisco, Calif. • 6500 N.E. Halsey St., Portland, Oregon.

NOTE: Simonds Segmental Saws (either tongued or slotted type) are made of tough shock-resistant alloy steel saw plate with accurately fitted High Speed Steel toothed segments securely riveted to the rim. Saws are also available with carbide tipped segments for cutting aluminum and magnesium.



Factory Branches in Boston, Chicago, San Francisco and Partiand, Oregan, Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Heller Tool Co., Newcomerstawn, Ohib, Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada



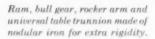
# BUSSELL, BOLBROOK & BEINDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

# SHAPERS Smith & Mills

# Smith & Mills for production and tool room

Compare Smith & Mills with any other shaper for versatility, speed, cutting power and precision performance. Compare and you'll buy Smith & Mills—famous for high quality shapers since 1888. Write or wire for prices, deliveries, repair parts or field service. Smith & Mills Shaper Division, Nebel Machine Tool Corp., 3411 Central Parkway, Cincinnati 25, Ohio.



Smith & Mills Shapers now available in Heavy Duty, Models in 16", 20", 25", 28", 32" and 36" strokes, and Standard Duty Models in 20" and 24" strokes.



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-258-1



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NEW YORK 12, N. Y.

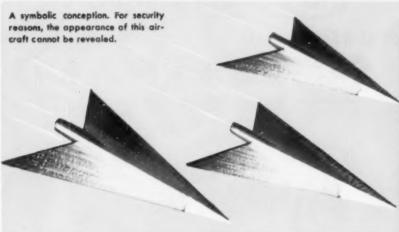


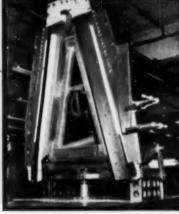
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USE READER SERVICE CARD; INDICATE A-10-258-4

200-TE LAFAYETTE STREET





A master drill and setting gauge, showing use of Epon resins to duplicate compound curves and contours.

# In building the supersonic Arrow . . .

Avro Aircraft, Limited saves time and money with

# **EPON® RESIN**

# dies, tools, jigs, molds and fixtures

Avro Aircraft, Limited—developing Canada's supersonic Arrow—is achieving major savings with Epon resin tooling.

Epon resins provide faster, lower cost preparation of stretch dies, forming tools, drop hammer dies, jigs, duplicate master die molds, checking and assembly fixtures. Avro reports that in making dies of Epon rather than metal, manpower requirements are two-thirds less, which is reflected in correspondingly great savings in the unit cost of tooling.

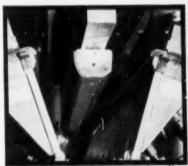
The Epon resins have an ideal combination of properties for tooling applications. To list just a few:

- Exceptional dimensional stability, high impact strength, excellent resistance to abrasion, minimum residual stress in cured parts.
- · Ease and speed of preparation.
- Low shrinkage in filled formulations, assuring perfect master reproduction; minimum warping and stresses.
- · Adaptability to repairs and design changes.
- Minimum finishing requirements for smooth surfaces.

Like Avro, other leading manufacturers report savings as high as 80% with Epon resin tools and dies—for *production* as well as experimental and short-run work. Can you make comparable savings in your own operations? Find out by writing for technical literature on Epon resins for tool and die applications.



Epon-faced die requires only hand rubbing to achieve smooth finish. Radii are being touched up with sander.



Stretch die, with Epon resin facing of involved contours, ready for run on 800-ton press.

# SHELL CHEMICAL CORPORATION

CHEMICAL SALES DIVISION, 380 Madison Avenue, New York 17, New York

Atlante - Beston - Chicage - Cleveland - Detreit - Houston - Los Angeles - Newark - New York - San Francisco - St. Louis IN CANADA: Chemical Division, Shell Oil Company of Canada, Limited - Montreal - Toronto - Vancouver



# Before you buy any turning equipment see what you get from

# SUNDSTRAND



# This Sundstrand Automatic Lathe tripled production of aluminum pistons!

Piston production jumped to 120 per hour, compared with 40 on former equipment, as the result of the change to a Sundstrand Model 8A Automatic Lathe at Wisconsin Motor Corp., Milwaukee. Operations performed include ruffing and finishing the ring grooves, finish turning the outside diameter, facing the piston top, and chamfering the ring grooves - all in a total machining time of just 10 seconds.

In addition to effecting a sizable boost in production, this Sundstrand automatic lathe eliminates the need for finishing and chamfering the ring grooves in a separate machine, as was formerly required. That's the often told story of Sundstrand turning equipment — high produc-tion, reduced handling, and improved accuracy on the broadest possible cross section of parts during short, moderate, and long runs.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS







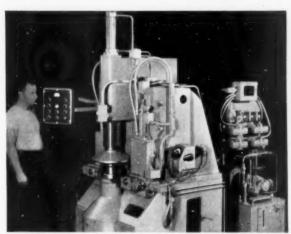






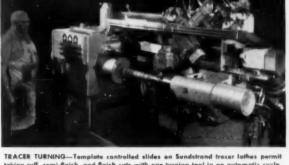
# "Engineered Production" MAKES THE DIFFERENCE

Any turning job is sure to benefit from the application of years of production and design engineering experience to the machine you get from Sundstrand. In addition, you know the choice will be made from the broadest possible range of machines. The machine on the facing page is an example of how a standard automatic lathe can be provided with multiple tooling for long run turning. On this page are vertical, tracer, multiple tool, and special turning lathes that are setting outstanding performance records.

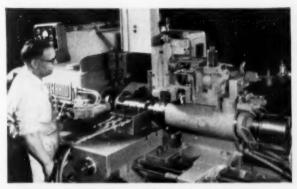


VERTICAL TURNING—This Sundstrand vertical automatic production lathe is basically a standard machine with platens for mounting turning or grooving slides, multiple tool slides, or tracer slides. Floor space requirements are reduced materially, and automatic handling can be applied readily. One operator can readily handle several of these machines.

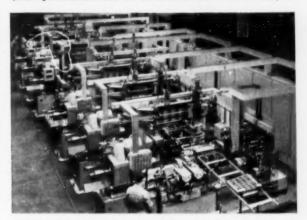
More facts about Sundstrand turning equipment are available in Bulletin 784. Write for your copy today.



TRACER TURNING—Template controlled slides on Sundstrand tracer lathes permit taking ruff, semi-finish, and finish cuts with one turning tool in an automatic cycle. Axie shafts, stem pinions, and similar irregularly shaped parts are typical of those being turned with high efficiency.



MULTIPLE TOOL TURNING.—Where a variety of turning, boring, facing, and forming operations are required on a particular part, Sundstrand automatic lathes can be provided with a combination of tools mounted on front, rear, and everhead carriages, permitting the maximum number of surfaces to be machined in a short machine cycle.



SPECIAL TURNING—Where production requirements are high, Sundstrand special automatic loading process lathe lines, like this one for automative comshafts, insure high output of top quality work. The part goes through the complete line without any manual handling whatsoever.

#### TRIPLEX RIGIDMILS

SPECIAL MACHINES





# SUNDSTRAND Machine Tool Co.

2540 Eleventh St. . Rockford, III., U.S.A.

# "Engineered Production" Service



# It takes all 5

#### American's "Engineered Production" Service

... gives the broach-user the complete three-part service that is essential to obtain the most practical broaching method. Years of design and production engineering experience, unavailable at any price, are effectively added to your staff at no extra cost.

**THE JOB**—Broaching ten 1.042 — 1.0435 wide internal splines in an automotive brake drum in a single pass.

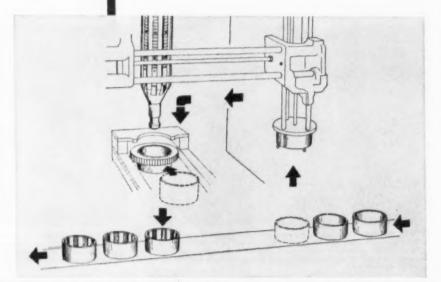
**THE RESULT**—Fully automatic cycle produces 125 parts per hour on vertical hydraulic internal pull-down machine.

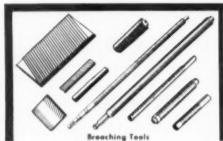
# PROPER BROACH

Top-quality results on any broaching operation require starting the job with design of the broaching tool itself. In solving this all-important first step, American Broach considers stock removal, length and width of cut, finish tolerances required, etc. High-quality work and long tool life result because broach and machine are designed to operate as a team. For maximum economy on this job, the broach tool is made up of ten sectional surface broach assemblies mounted on an arbor. Maximum user benefit is obtained by easy removal for sharpening and replacement.















Herizental

# to give you peak broaching performance

Production rate required, length and speed of stroke, relationship to other production machinery, available floor space, etc. determine the selection of the broaching machine capable of doing the best job. At American, machine selection follows design of the broaching tool. This vertical hydraulic internal pull-down machine has a full follow-up retriever mechanism and elec-

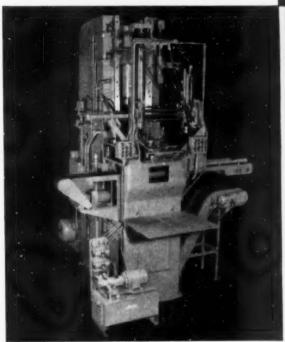
trical controls. A swinging boom is used for

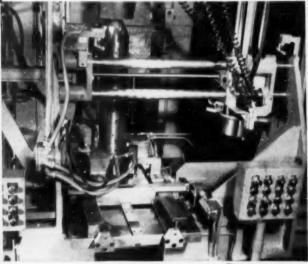
loading and unloading the broach and an

automatic chip conveyor unit is provided.

SPECIFYING THE

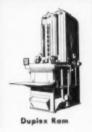
Whatever your parts geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. In this installation, a hydraulically operated loading mechanism with an internal chuck picks up work from a conveyor and inserts it in a collet-type fixture for broaching. Finished work is automatically ejected to conveyor line. Because "skills" are built into the tool, machine, and fixtures, production schedules are maintained even with inexperienced operators.





More facts are available in American's Pull-Down Bulletin A719. Write for your free copy today.







SUNDSTRAND

BROACH & MACHINE DIVISION
SUNDSTRAND MACHINE TOOL COMPANY
ROCKFORD, ILLINOIS



Utility Tools

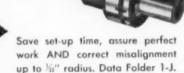
UTILITY

Use lower-cost, straight shank small tools with these Removable Taper Shank Sleeves. Data Folder 1-A.

LIVE CENTERS

Cushioning reduces tool breakage
—Timken Roller bearings give accuracy, long life. Data Folder 1-D.

FLOATING TOOL HOLDERS



# Specialized Service for 40 YEARS

Time-saving, money-saving Glenzer tools are specified standard by manufacturers throughout the country.

THE J. C. GLENZER CO., Inc., 1552 E. NINE MILE ROAD, DETROIT 20, MICH.

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# THRIFTMASTER

your source for dependable

## DRILLHEADS



Universal Joint Type Drillhead . . Full Ball or Bronze Bearing Construction, Standard or Heavy Duty. From 1/5" minimum centers up. Capacities to 1/2" in Steel.

Gear Driven Eccentric Type
Adjustable Drillhead
Enclosed, Fuil Ball Bearing
Construction. Double Eccentric Type Adjustable
Drillhead illustrated.



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- Write for your free copy of the THRIFTMASTER CATALOG or phone for a rush, on-the-spot, quote.

Makers of DORMAN AUTOMATIC REVERSE TAPPERS



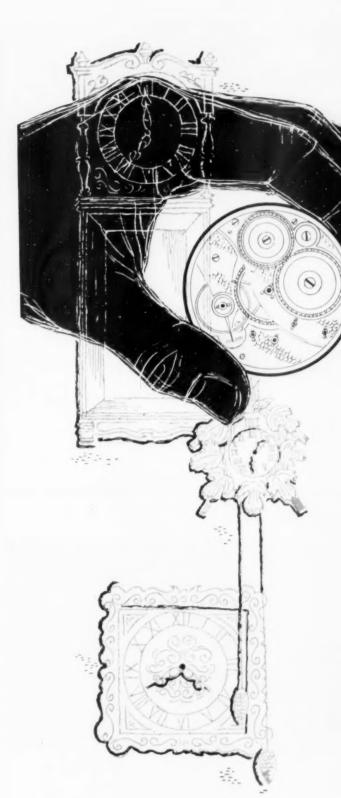
A SUBSIGNARY OF Lancas
THOMSON INDUSTRIES, INC.



1004 N. Plum Street Lancaster, Pa.

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The Tool Engineer



Does

# Graftsmanshíp

Still Live?

At The Pipe Machinery Co., the people who develop, produce and ship gages to you feel you deserve craftsmanship when you order our gages.

Because of this dedicated pride of theirs, they do some remarkable things freely—willingly. The plant, their machines, their tools, are in apple pie order. They want it that way. They do better work—easier—that way.

Many times they do little extras, that prove to us that they are as interested in giving you service as they are in their own pride of workmanship. Yes, craftsmanship lives here.

If you are going to be in the Cleveland area soon, drop in and see us.

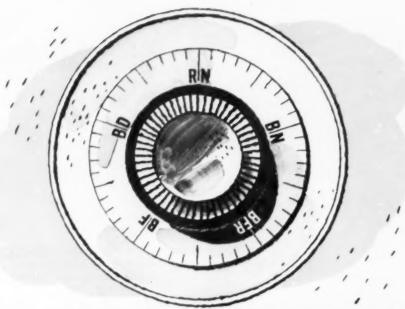


# THE PIPE MACHINERY COMPANY

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Greater Cleveland



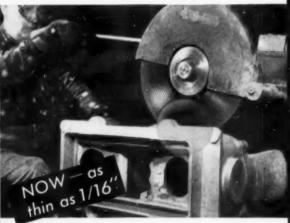
# Your "RIGHT COMBINATION" for countless grinding jobs

The BIG 5 in Reinforced Wheels



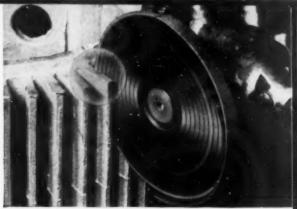
# RN WHEELS - Glass Cloth

New — for the foundry and lower priced! Norton has been field-testing a new rubber-bonded-reinforced wheel. It's ready now and well worth your investigation for savings in your cutting-off operations on ferrous and non-ferrous metals.



# BN WHEELS - Glass Cloth

Ten inch diameter wheels can now be had 1/16" and 3/32" thick. In this range specify A36TBN. For heavy duty work, requiring larger and thicker wheels, specify A24R14BN. Use them for slotting, for cutting-off non-ferrous metals, wire rope, many non-metallic materials.



# BD WHEELS - Glass-Nylon

For fastest cutting on right-angle grinders you'll want the glass cloth reinforced resinoid bonded hub wheels of rigid type. Use for medium to heavy weld grinding and smoothing flame-cut edges. Specify A24NBD for fast cut, A24QBD for long life. For cutting-off, A24RBD which is Nylon reinforced.



# BFR WHEELS - Cotton-Nylon

Top performers for light, portable grinding. These semiflexible resinoid wheels have cotton fabric with an additional layer of Nylon for added safety. Specify A24KBFR for weld smoothing, removing scale, light finishing, minor cut-off jobs, etc.

# Norton Reinforced Wheels are built in many different varieties ... to add the "TOUCH OF GOLD" in many different ways

There's no limit to what the complete line of Norton reinforced wheels can do for you, in the widest range of everyday grinding jobs — from light deburring to heavy cutting-off.

That's because each type combines exactly the right abrasive, reinforcing web and bond to assure exceptional strength and safety — plus fast, cool, trouble-free performance. Remember: only Norton offers you such long experience in both grinding wheels and grinding machines . . . which means these particular wheels are sure to bring you the money-saving, value-adding "Touch of Gold" on job after job, day after day.

Also, Reinforced Mounted Wheels and Sticks are available. Here we show just five of the popular reinforced wheel types. For plenty of further facts, read our Booklet No. 1748. Get it from your Norton distributor — together with fast, helpful service. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors all around the world.



## BF WHEELS - Cotton

These resinoid straight wheels with cotton fabric reinforcement are "the right combination" for peripheral grinding, do a fine job of deburring and finishing. Fine for blending and smoothing light welds. Also available in mounted wheels and sticks.

W-1814



Making better products ... to make your products better

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Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING DIVISION

Coated Abrasives 

Sharpening Stones 

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BAY STATE



# PRECISION PERFORMANCE...

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To tap users, precision performance means production-line continuity, better threaded parts, increased tap life . . . and BAY STATE!

BAY STATE TAPS

Bay State Tap & Die Company Mansfield, Massachusetts

On the nearby shelves of your Industrial Supply Distributor





PS-A-307L Air Sander being used to prepare metal for painting.

# These great features make this air sander right for you!

- Short angle head for close quarter work!
- . 5900 rpm. for faster metal removal!
- . Light weight-only 51/2 lbs.!
- . Built-in automatic oiler!
- · Automatic speed regulator!
- . Heavy duty angle bevel gears!

Here is the perfect angle air sander for both light and medium metal removal jobs. With its power and its speed—5900 rpm.—it can do the "in-between" jobs as well as a heavy duty sander... and you don't pay for power you don't use! Though light in weight, it is the huskiest sander in its class! And its light weight—only 5½ pounds—helps reduce fatigue.

Designed for close quarter work, the Model PS-A-307 air sander is only 3 %

inches from pad to top. It can be used to grind sheet metal and light plate welds, to remove die "dings", to prepare metal prior to enameling or painting and for other metal jobs. It is built with all the quality and precision that have made Remington—manufacturer of sporting firearms and ammunition—famous for 141 years. For full information on the complete Remington line of Mall air tools, just send the coupon.



Impact wrenches electric and air



Multi-purpose



Midget collet die grinders, Variety of sizes.

Prices and specifications subject to change without notice.

Remington

Mall MALL TOOL COMPANY,
Division of Remington Arms Company, Inc.,

Bridgeport 2, Connecticut

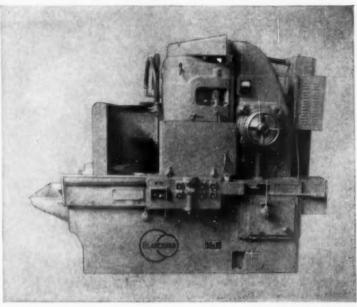
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Blanchard specializes in the manufacture of segments and cylinder wheels for Blanchard and other Vertical Spindle Surface Grinders. If you have a difficult grinding job, whatever the material may be, or if you are not satisfied with the results you are now getting, let us help you.

Blanchard wheels are the quality wheels for Blanchard Grinding. Use them to get maximum performance from your Blanchard!

PUT IT ON THE



Please send me a free copy of "The Art of Blanchard Surface Grinding" (3rd Edition).

# THE BLANCHARD MACHINE COMPANY

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# Protect Hydraulic Systems 3 Ways

# ...WITH SINCLAIR DURO HYDRAULIC OILS

# 1. STOP RUST!

You stop rust everywhere in your hydraulic system with Sinclair DURO Oils! Water in the system can't reach metal surfaces because Sinclair's rust inhibitor is a preferential metal-wetting agent that plates out on surfaces, and stops moisture-to-metal contact.

# 2. FIGHT OXIDATION!

Two special inhibitors in DURO Oils give you extra protection against oxidation of the oil, and prevent the formation of oxidation by-products. Thus, your hydraulic system stays free of varnish, sludge and corrosive acid... highly important in today's advanced equipment!

# 3. PROTECT AGAINST FOAMING!

Sinclair adds a highly effective anti-foam agent to DURO Oils. This keeps air bubbles from being retained in suspension, thus assuring positive control and continuous lubrication with less wear. Sinclair DURO Oils give you smoother, full power transmission!

Look to the "big three" benefits of Sinclair DURO, the high viscosity index oils for hydraulic systems... they're designed to give you the maximum performance at the higher temperatures, greater pressures, and faster speeds of modern hydraulic systems. Your Sinclair Representative can give you full information, or you can write for literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. There's no obligation!

# SINCLAIR DURO HYDRAULIC

# JIG GROUND with

# ulcanair



A five station indexing fixture from Vulcan's Contract Tool Room (Your tool room in Dayton).

Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result - eliminated all close locating and dowelling of individual parts and of course hours of time.

\*Vulcanaire equipment pays for itself on the first job.

> Borrow our instructive 11 minute movie on Jig Grinding.

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TOGGLE CLAMPS **FIXTURE CLAMPS** COMPONENTS

TOGGLE CLAMPS Over 80 TYPES & SIZES

FIXTURE CLAMPS Over 170 TYPES and SIZES



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# **Drill Hardened Steels** without Annealing -



With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in seeds hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbonhigh chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

You Harden It-We'll Drill It-WITH "HARDSTEEL"

BLACK DRILL COMPANY, INC.

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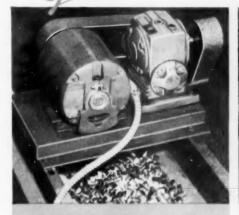
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# Cost-wise design calls for STANDARDIZED

BOSTON SPEED REDUCERS



BOSTON GEAR
Standardized
Speed Reducers
take top-rating
in any test.
Why pay more,
— why wait,
for "specials?"



LASTING POWER ECONOMY, long wear, easy maintenance and quiet operation make Soston Gear Speed Reducers the practical choice for drives in materials handling equipment. A 100 Series Model T Reductor is used in the conveyor drive illustrated, where production of 4,000,000 lamp bases per day requires continuous, trouble-free operation.



COST OF SPECIAL MACHINES IS MUCH LESS when designed around Beston Gear Standardized stock components. A 100 Series Model YMW Ratiomator drives this automatic stripping and soldering machine for fuse plug lead wires. Assembly also includes standard stock Boston spur gears, rack, pillow blocks, pulleys, sheaves, and bushings.

# 1605 TYPES and RATIOS FROM STOCK

#### REDUCTORS



Ratios 1:1 to 3600:1 .004 to 50 HP

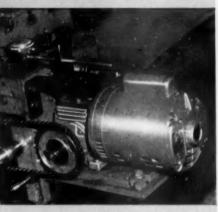
# RATIOMOTORS Output RPM .49 to 175



#### FLANGED REDUCTORS



Catalog No. 56 lists complete specifications — selection data



INCREASED COOLING EFFICIENCY of the finned housings of Boston Gear Speed Reducers dissipates heat rapidly. This permits compact design and higher torque capacity, of special advantage in machine tool drives like the 100 Series Model M Ratiomotor illustrated, and where spaces is limited, or where high area temperatures prevail.



STANDARDIZED VARIABLE SPEED DRIVES, assembled from Boston Gear stack parts, simplify the design jab, and save the time required to procure special equipment. The illustration shows a Boston Gear Variable Speed assembly with a Type TW Reductor, used with Boston stack spreakers and chain to drive conveyor belt of a heat-tracing furnace.

Your nearby Boston Gear Distributor can furnish any model you need, from stock. His factory-trained specialists will advise you on selection to simplify design and assure maximum economy. Be cost-wise . . . STAND-ARDIZE and SAVE. Boston Gear Works, 83 Hayward St., Quincy 71, Mass.

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BOSTON Jewe .

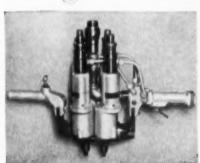


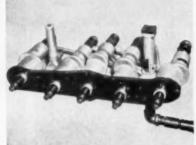
7124 "OFF-THE-SHELF" TRANSMISSION PRODUCTS FROM STOCK — AT FACTORY PRICES — ASK FOR CATALOG Stock Gears • Sprockets and Chain • Speed Reducers • Bearings • Pillow Blocks • Couplings

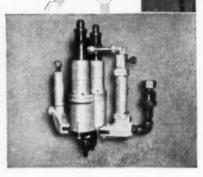


PATTERN OF COST REDUCTION

... with Keller Tool nut setters







TAKE FOUR

TAKE FIVE

TAKE TWO

Take one—a Keller Tool 16J-48 air-powered spindle. Here's a motor unit designed specifically for multiple nut running. It has a built-in pressure regulator, so individual close-tolerance torque control to each motor unit is quick and easy.

Take many—add a throttle-handle, dead handle, and a mounting plate tailored to the job, and you are in production. Put the handles where you want them. Bolts at different elevations or different angles are easily accommodated. And each spindle can be set to tighten the nut to individual torque specifications.

Take apart—when a run is finished, when bolt patterns change—and set 'em up again!

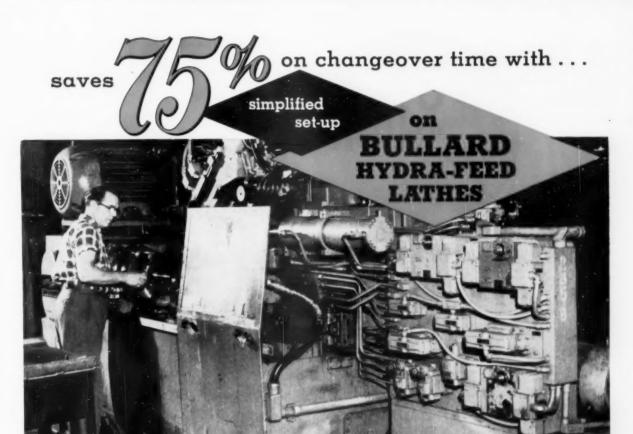
With a Keller Tool multiple nut setter you buy a production tool of outstanding versatility, that pays off fast in the time it saves, for a minimum investment because of standardized components. Send for descriptive Bulletin No. 101.



ENGINEERING FORESIGHT—PROVED ON THE JOB IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

**GARDNER-DENVER** 

Gardner-Denver Company, Quincy, Illinois



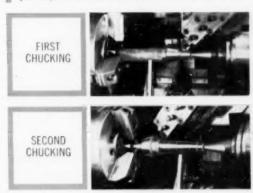
Hlustrated below is one of more than forty different pinions processed on the same Bullard Hydra-Feed Lathes

"Unless the consecutive set-ups from one job to another were similar," reports the Foreman of a large midwestern automotive parts manufacturer, "changeover set-ups took from ten to sixteen hours. But now, with Bullard Hydra-Feed Lathes, and going from one extreme to the other, the changeover is accomplished in less than four hours."

Additional reasons for their enthusiastic acceptance of Bullard Hydra-Feed Lathes include less spoilage, greater accuracy, better finishes and reduced machining time over previous method.

These advantages can be applied to your machining requirements. Call your nearest Bullard Sales Office for full particulars or write

BULLARD COMPANY BRIDGEPORT 9







Remember - to cut costs when cutting metal - buy (





# producer of the original low hung drive

Check this exclusive combination of Carlton advantages:

Low hung drive: created by Carlton, widely copied but never duplicated.

Wide selection: 5 models and many arm and column sizes.

Greater capacity: broad range of speeds and feeds; practically any combination of tap leads available.

Programming, pre-selector, partial pre-selector or manual speedfeed control.

Super-precision column clamp; 360° clamping for 20% more rigidity, greater accuracy.

3-unit power clamping: arm, head and column, for easier and more economical operation.

Positive tooth feed clutch: provides constant feed to the spindle regardless of density of metal.

Easy, economical maintenance: only one friction clutch; 100% interchangeability of parts.



A versatile radial drill with hole drilling range from 1/4" to

1¾ " diameter. Offers many of the exclusive Carlton design, construction and operating advantages shown at left.





A medium duty radial drill with a hole drilling capacity of 1/4" to 21/4" diame-



ter. Like all Carlton radial drills, the 1A has the super-precision column clamp and the anti-friction mounted head.

Model	Column	Arm	No.	Peeds Range	No.	Range	Motor
0A	9*	3'-4'	9	20 to 1	4	.006020	3-hp
1A	9° 11°	3'-4' 3'-4'-5'	12	25 to 1	6	.006025	5-hp 5 or 71/ <sub>2</sub> -hp
SA	13° 16° 17°	4'-5' 4'-5'-6' 5'-6'-7'	36	100 to 1	18	.004125*	7½, 10, 15 or 20-hp
4A	19"	6'-7'-8'	36	100 to 1	18	.004~.125*	15, 20 or 25-hp
5A	22° 26°	7' to 10' 8' to 12'	36	100 to 1	18	.004125*	20, 25 or 40-hp

<sup>\*8,</sup> 11%, 14 and 18 threads per inch are standard, with various other combinations available.

# presents the modern design radial drill

presents the modern design radial artic

The 3A, 4A and 5A Carlton radial drills offer you a choice of four speed-feed controls:

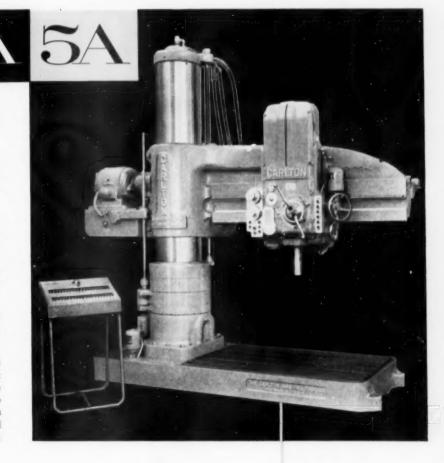
**Programming** for pre-selecting speeds and feeds for an entire drilling program including as many as 20 or 30 operations.

Pre-selector for setting speed and feed for the next operation while machine is still under cut.

Partial pre-selector selects 36 spindle speeds; feeds shifted manually.

Manual to take advantage of Carlton's centralized push button control.

In addition, these three models give you all the exclusive Carlton advantages shown on the opposite page. No wonder leading machine tool buyers say that Carlton is the ONE modern design radial drill. The Carlton Machine Tool Co., Cincinnati 25, Ohio.





SPECIALISTS IN RADIAL DRILLS



# HAMIKLEER Coolant

Company after company has tested and proved that HAMIKLEER eliminates the expense of many different coolants, lubricants and rust preventives. This one, all-purpose, odorless, synthetic coolant is being widely used for practically every cutting, grinding or aqueous phase operation on cast iron, hard and soft steels...is saving the heavy cost of cleaning operations by preventing rust, even in hot, humid weather...and is increasing tool life with its excellent lubricity and anti-weld properties.

#### In addition, HAMIKLEER . .

- Speeds Up Preduction by keeping work cool at all times for faster, uninterrupted praduction. HAMIKLEER saves preparation time, too, since it dissolves instantly in any kind of water—even the hardest.
- Reduces Rejects by keeping work cool, clean and visible and assuring finer surface finishes. HAMIKLEER will never cloud or gum and it removes previously accumulated scum and gum formations.
- Lasts Lenger because it makes "water-thin" solutions in any ratio of dilution and kolds the amount carried away to a minimum. HAMIKLEER can be used over and over again.
- Eliminates Costly Disposal Problems because its "water-thin"solution form never becomes gummy. HAMIKLEER can always be disposed of through regular outlets, if oils do not get into the mixture, and it won't pollute streams.

#### Send For FREE SAMPLE

... of HAMIKLEER to test on your own metalworking operations. A FREE BOOKLET on HAMIKLEER is also available



Manufacturers of HAMIKLEER, ACTIVOL, HAMIKOTE, STEELGARD, IMMUNOL



#### TESTING KIT FREE

... to all HAMIKLEER users to permit quick, accurate determination of dilution right at the machine.



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MULTI-MILLION

CYCLE TRIALS

STRENGTH AND DURABILITY

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The largest, most dependable die spring line ever assembled. The exact spring for your operation . . . in stock at your Danly Branch Assembly Plant or distributor.

DANLY SPRING RETAINERS FOR. INDIVIDUAL

SETTING OR REPLACEMENT

All steel with zinc plate finish.

New catalog simplifies spring selection. Write for your free copy today.

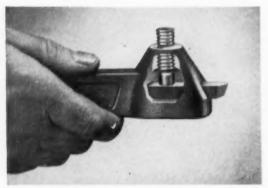
DANLY MACHINE SPECIALTIES, INC.

2100 S. Laramie Ave., Chicago 50, III.

THE COMPLETE LINE OF DIE MAKERS' SUPPLIES . . . IN STOCK!

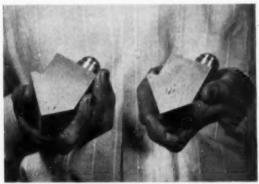
# Practical Tooling Tips

Number 1 of a series.



TO GET GREATER TOOL BIT RIGIDITY replace the tool holder screw with a Vlier Swivel-Pade Clamp. The large, flat pad face provides many times more clamping area. Bits can be held tighter, reducing chatter and vibration. Small, narrow cut-off blades, multipoint tools, even stub ends can be rigidly held. Unique ball joint construction gives smooth angle adjustment in all directions.

Everyday more and more shops are using standard Vlier Tooling Accessories in place of custom-made devices for both tooling and original equipment applications. The precision construction, product uniformity and quick availability of these simple time-savers have made them tool room favorites. Why don't you start saving from their use?

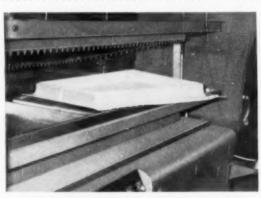


EASY WAY TO STOP MARRING surface of part held in fixture. The part on the left was securely held in the fixture with a Vlier Swivel-Pad<sub>©</sub> Clamp. The scrapped part on the right was held with an ordinary set screw. With the Vlier Swivel-Pad<sub>©</sub> Clamp the pad stops at first contact with the part; screw torque is absorbed by a ball, preventing damage to the part. This exclusive ball joint construction also provides adjustment to off-angle surfaces.



SPRING PLUNGERS LET WRENCH DO MULTIPLE DUTY—The compression tool shown above is used to attach connectors to electrical wires. Formerly, each size wire connector required a different size tool. But now, through the use of Vlier Spring Plungers, one tool attaches all sizes of connectors—through the use of changeable jaws. The appropriate jaw for any size connector is easily inserted, accurately positioned, and held in place with a Vlier Spring Plunger.

New catalog now ready! Send for your copy today.



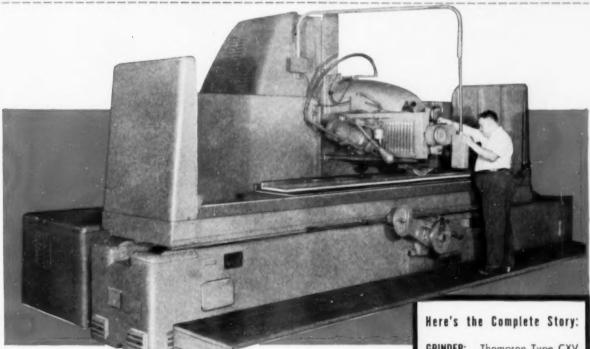
THE RIGHT AMOUNT OF END PRESSURE AND NO MORE is what this spring plunger application calls for. More than 150 Vlier Spring Plungers are used to hold a plastic sheet in position during the forming operation of a plastic refrigerator door liner. Spring Plungers provide just the right amount of pressure to produce a perfect liner.

Insist on Vlier Tooling Specialties...
there's still no substitute for quality.

8900 Santa Monica Blvd., Los Angeles 46, California

# When large parts must be ground to total tolerances of .0005" or less . . . .

# THOMPSON GRINDERS WITH THE NEW HYDRA-COOL HYDRAULIC SYSTEM SOLVE THE PROBLEM!



Machine ways up to 118" for The Michigan Tool Company's Roto-Flo Spline Rollers must be ground to .0005" total tolerance. Heat distortion, caused by hydraulic heat, became a critical problem in achieving this tolerance.

During the three months of operation since the installation of Thompson's new Hydra-Cool Hydraulic System\*, these long ways are being ground to consistent .0003"-.0004" total tolerances. Heat distortion is eliminated. Scrap loss is reduced to zero. Grinding time is greatly reduced.

THOMPSON GRINDERS WITH THE NEW HYDRA-COOL HYDRAULIC SYSTEM MAY BE THE ECONOMICAL SOLUTION TO YOUR GRINDING PROBLEM. WRITE TODAY FOR FULL PARTICULARS.

Hydra-Cool also offers you these exclusive advantages:

- Heat damage to hydraulic seals, valves, controls and pump is eliminated.
- Break down of additive-type hydraulic oils is prevented-sludge will not form in the Hydra-Cool System.
- · Lengthy warm-up periods are eliminated.
- Power costs are greatly reduced.

Hydra-Cool is standard on all Thompson surface grinders 40 inches and up in work length AT NO EXTRA COST. GRINDER: Thompson Type CXV 36" x 36" x 120" with horizontal and vertical heads.

PART: 118" way for Michigan Tool Co. Roto-Flo Spline Roller.

RATE OF TABLE TRAVEL: 100 ft./Min.

MATERIAL REMOVED: .065".

METAL: Flame hardened Ductile

WHEEL: 20x4x12 H Grade.

SCRAP LOSS: None. GRINDING TIME: 3-4 hrs.

THE THOMPSON GRINDER CO., Springfield, Ohio, U. S. A.

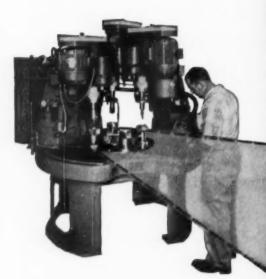
\*Pat. Applied For

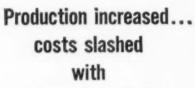
"Keep THOMPSON in mind for that daily grind"

October 1957

GRINDERS

Hartford Special Multi-operation Indexing Machine equipped with four Skinner Power Chuck Fixtures





# Skinner Power Chuck Fixtures

Four Skinner Power Chuck Fixtures mounted on an index table recently helped Hartford Special Machinery Company develop a low-cost, high-production machine for a customer that assured top quality at a lower part cost.

In this application, each Power Chuck Fixture holds a work piece and is indexed to three working stations for machining.

The operator has only seven seconds to unload and load, yet can keep up the pace all day long, thanks largely to the effortless releasing and gripping of the air-powered fixtures.

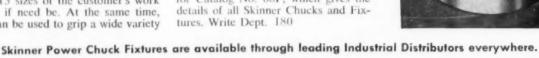
Skinner Power Chuck Fixtures are compact, but versatile enough to hold up to 15 sizes of the customer's work pieces, if need be. At the same time, they can be used to grip a wide variety

Non-rotating Skinner Power Chuck Fixtures are ideal for holding work on drilling and milling machines, for assembly operations and for other bench and machine installations.

They're operated by air for fast, effortless loading and unloading. The compact units are available in several sizes, with either two or three adjustable or non-adjustable jaws.

See how you, too, can profit from the accuracy, speed and strength of Skinner Power Chuck Fixtures. Send for Catalog No. 68P, which gives the details of all Skinner Chucks and Fixtures. Write Dept. 180

of other work for drilling, machining, or assembly operations.





# THE SKINNER CHUCK COMPANY

NEW BRITAIN, CONNECTICUT

ROCKWELL-BUILT

# DELTA drill presses



# ... save cost of expensive machines

for General Bronze Corp., Garden City, N.Y.

FLEXIBILITY NEEDED—"Producing custom ornamental metal work for architectural use calls for limited production runs and fast product output," says Joe Gafney, Plant Engineer, "and Delta drill presses give us maximum flexibility to meet these constantly changing production demands."

PRECISION AT LESS COST—This Delta drill press set up drills, countersinks and counterbores over 500 bronze window blocks per day, with precision that eliminates costly rejects. And stock Delta power tools provide an inexpensive way to meet peak work loads and prevent bottlenecks.

Send Coupon for All the Facts!



another product by



LONG LIFE, LOW MAINTENANCE—
"We have some Delta equipment that has been in regular use for over 15 years," says Mr. Gafney, "and still performs with almost no maintenance. Rugged construction and low-cost maintenance are Delta Quality features we really appreciate."

SEE THE ENTIRE DELTA LINE—Get all the facts on the world's most complete line of drill presses and accessories. Compare for quality, for value—and make up your own mind. Your Delta Dealer is listed under "TOOLS" in the Yellow Pages of your telephone book.

	wer Tool Div., Rockwell Manufacturing Co. Lexington Ave., Pittsburgh 8, Pa.
	send catalog on entire Delta Drill Press line.
Please	send booklet: Power Tools Teamed with Machine Tools.
Please	send names of my nearest Delta Dealers.
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DOUBLE CRANK PRESS

### THESE 40-TON PRESSES

take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are very moderately priced.

Significant savings may result if you let our engineering staff as-sist you. There is no obligation.

Rousselle Presses are sold exclusively through leading machinery dealers.

Choice of 25 models in 5 to 40-ten sizes.

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- High output with close tolerances.
- . Fast—easy to operate. Ideal for second operations.
- Versatile-easily tooled.
- 48 each of longitudinal, cross and thread cutting feeds.
- Power feed turret ram.
- swing-138" spindle holecollet capacity
- Prices start at \$2438.





CATALOG

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SOUTH BEND LATHE . South Bend 22, Indiana

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#### Well-known makes of home appliances are gaged with Comtorplug



#### COMTORPLUG. Interchangeable expanding plugs gage simple or special bores from 1/8" to 10" diameter.

#### UNIQUE ADVANTAGES

- . Large dial with .0001" grad-
- Indicates actual size, a fixed
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- · Portable no wire, hoses, stands or electronic gear.
- Positive 2-point gaging automatic centering.
- Assured accuracy regardless of who operates it.
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- Reaches to bottom of blind
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- A shop tool for all-day every day use.

Anybody can use Comtorplug with positive accuracy . . . at machine, bench, lab . . . anywhere, since it's unencumbered by wires, hose, heavy base or electronic gear. The same amplifier fits all plugs and fixed readings show ACTUAL SIZE, front or back taper, ovality, etc. Whatever problem bore you have in mind. COMTORPLUG may be the answer.

COMTOR COMPANY 69 Farwell St. WALTHAM 54 MASS.

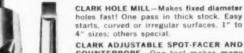


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## Efficient M-3 High Speed Steel Clark HOLE-PRODUCING TOOLS

for production jobs on STAINLESS & ALLOY STEELS!



COUNTERBORE - One tool makes many diameters. Easily reground and reset. Heavy cuts in mills, drills, radials, turrets. " to 4" sizes; others special.

Write for information on all Clark HOLE PRODUCING TOOLS!

Robert H. Clark Company 9330 Santa Monica Blvd., Beverly Hills, Calif.

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# ALEXANDER DIE-SINKERS



Hole Mill

Clark

Adjustable Spot-Facer &

Counterhore

for 2 or 3 dimensional work

Latest model, No. 3A for molds and dies up to 1000 lbs. Ratios from 1.5:1 to 10:1, 14 spindle speeds from 475 to 9500 rpm, cutters up to 3/6" dia. Two smaller sizes, 1A and 2A.

Get a close look at Alexander engravers, dieset a close look at Alexander engravers, dies-sinkers, and cutter grinders—optical dividing head, centering and cutter grinder microscopes, cylinder roller attachments and other acces-sories. Write for catalog D on these quality, British machines.

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#### STARRETT PRECISION MAKES GOOD PRODUCTS BETTER



# STARRETT precision ground FLAT STOCK and DIE STOCK fastest way to make small parts...costs less

Just lay it out and saw it out . . . that's how Starrett Precision Ground Flat Stock and Die Stock help you handle those many special jobs that tie up valuable men and machines.

Anything with two flat parallel sides can be produced quickly and economically . . . no time lost hunting up stock — no slow and costly grinding to size. Choose the exact width, thickness and hardening characteristics you need.

Your Industrial Supply Distributor offers dependable service on Starrett Precision Ground Die Stock and Flat Stock — each piece marked for type and size and individually packaged in protective envelope. A new, compact, quick look-up chart lists all types and sizes with hardening instructions. Ask him for your copy or write Dept. E, The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

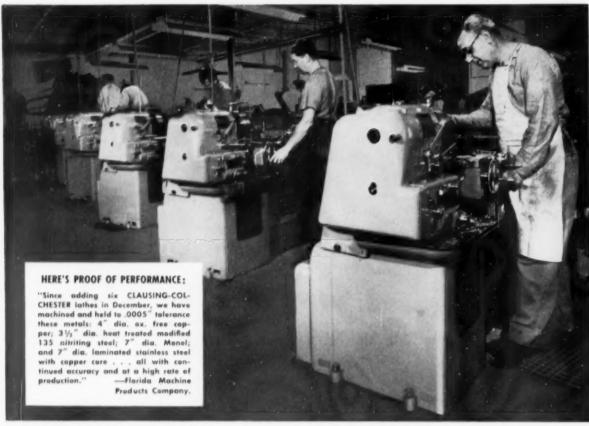




FLAT STOCK and DIE STOCK

World's Greatest Toolmakers

PRECISION TOOLS . DIAL INDICATORS . STEEL TAPES . GROUND FLAT STOCK . HACKSAWS . HOLE SAWS . BAND SAWS . BAND KNIVES



### Performance records PROVE

# CLAUSING LATHES'

### Superior Construction . . . Greater Value

The statement of Florida Machine Products above is typical—users everywhere report Clausing geared-head lathes lead their field in capacity, performance and value. Here's why:

They're bigger in capacity than other lathes in their class. Larger spindles, larger thru-hole capacity, larger bearings for heavier work. (See chart at right.) Geared-head drive is powered by one or two speed motor thru multiple V-belts.

Have beavy-duty construction throughout. Beds are 50% steel, 50% iron with elliptical cross ribbing — ways are induction hardened and precision ground. Gears in head and quick-change box run in bath of oil — gear shafts are multi-splined. Power feeds are taken from separate feed rod, lead screw is used for thread cutting only. Spindles are high-tensile hammered steel forgings — note size. Note, too, the heavy-duty construction of tailstock and double-walled apron.

Built for precision performance — to American standards of toolroom lathe accuracy. Gamet Micron tapered roller bearings with oil flow lubrication — the most advanced and accurate bearings known to industry. And each Clausing lathe passes rigid tolerance tests before it leaves the factory. Each is an outstanding value. 13" cabinet base models, including motor and controls, start at \$1952; 15" cabinet base at \$2744; 17" at \$4345. You owe it to yourself to investigate before investing in any lathe.

#### LATHE CAPACITIES

17" lathe: \$4" and 78" centers, 28" swing in gap; 15" lathe: 30" and 48" centers, 24" swing in gap; 13" lathe: 24" and 36" centers, 18" swing in gap.

#### SPINDLE CAPACITIES

Lathe	17"	15"	13"
Thru-Hale	3-1/16"	2-1/16"	1-9/16"
Nose Taper Key Drive	L-2	L-1	L-0

#### BEARING

Lathe	17"	15"	13"
Front Spindle Bearing O.D.	7-1/2"	5-1/2"	4"
Rear Spindle Bearing O.D.	6"	4-3/8"	3-9/16"

SEE THEM AT THE NATIONAL METAL EXPOSITION, CHICAGO, ILLINOIS, NOVEMBER 4-8, BOOTH 1350

# CLAUSING DIVISION ATLAS PRESS COMPANY

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Exclusive features incorporated in these drills give greater tool life, faster cutting at lower cost.

High volume production facilities make tools available from stock.

Standards stocked in fractional, wire and letter sizes, in solid and tipped carbide; types for hardened steels, cast iron, aluminum, magnesium, plastics and abrasive substances.

Special Grind Faster Food Heavier Carbide Tip

Stronger Tip Support

Send now for our complete 36-page catalog just off

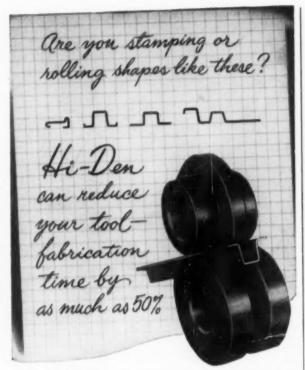


Guper-

QUALITY CARBIDE TOOLS

Division of Van Norman Industries, Inc.

DEPT. 328 + 21650 HOOVER RD., DETROIT 13, MICHIGAN
ES: CHICAGO - DETROIT - NEW YORK - LOS ANGELES



A large aircraft manufacturer\* reports HI-DEN rolls in a Yoder machine produced these short-run parts in stock sheared from sheet aluminum (in as-quenched condition) more satisfactorily and economically than other methods tested. And tool fabrication time was reduced 50%.

Another company\* found that a steel draw die which formerly required three passes to complete a draw, when faced with HI-DEN completed the same draw in one pass. HI-DEN treats the metal better.

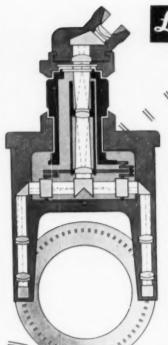
More than 100 different applications for HI-DEN have been reported by users . . forming, stretch, draw and press brake dies; jigs, fixtures, templates, pressure pads and many others. Ideal for use in Hydro-form or Mar-form presses.

HI-DEN, a compreg of selected wood veneers impregnated with phenolic resin (laminated and compressed under extreme heat and pressure) is far stronger than equal weight in steel, is lighter in weight, easier to handle, resistant to oil, alcohol and moisture, dimensionally stable — and is easily shaped with standard tungsten carbide tools.

\*Names on request

If you are forming light metal parts, HI-DEN has important advantages to offer. Why not send today for Technical Bulletin and literature showing how to improve quality while lowering costs? 

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ULTRA PRECISION IN SPACING

on guided missile components and similar critical work guaranteed by this exclusive DOUBLE-MICROSCOPIC PICK-UP of the LEITZ OPTICAL MASTER DIVIDING HEAD.

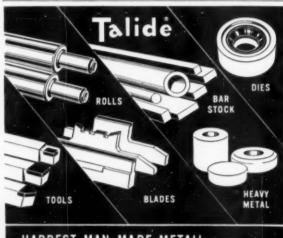
It compensates for run-out, the most common source of error. Working accuracy 1 second of arc.

There is no substitute for LEITZ in optical dividing.

Request catalog 82-1

# OPTO-METRIC TOOLS, INC.

USE READER SERVICE CARD; INDICATE A-10-288-2



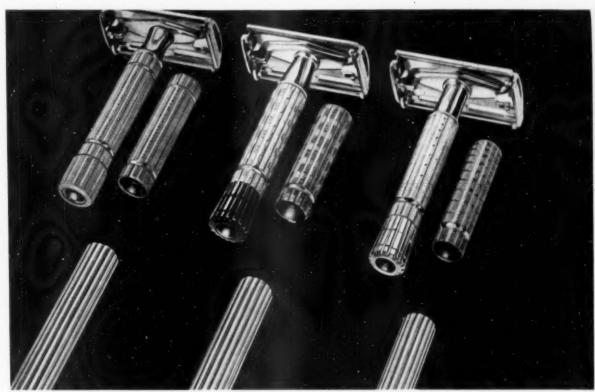
#### HARDEST MAN-MADE METAL!

New, improved TALIDE METAL is uniform in quality—gives top performance on ALL cutting, drawing and wear-resistant applications. Write for Catalog 56-G. METAL CARBIDES CORP. Youngstown 12. Ohio.



HOT PRESSED AND SINTERED CARBIDES - VACUUM METALS HEAVY METAL - ALUMINUM OXIDE - HI-TEMP, ALLOYS OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

USE READER SERVICE CARD; INDICATE A-10-288-3



Handles for the gold-plated (left) and standard "Heavy" (center) Gillette safety razors are made from Anaconda leaded commercial bronze special-shape seamless tube, .4525" O.D., .371" I.D. "Regular" model (right) is of commercial bronze .395" O.D., .324" I.D.

## Gillette shaves costs with Anaconda special-shape tubes

The problem: The Gillette Safety Razor Company, Boston, Mass., formerly used drawn shells for the handles of its famous line of razors. Press-fit assembly of components called for very close tolerances and suppliers of the drawn shell had difficulty in controlling the dimensions to the accuracy required. Rejects and production delays were becoming a costly problem to Gillette, and there was also excessive waste of material in trimming the shells after the knurling, grooving and rolling operations.

The solution: American Brass Company representatives suggested the use of special-shape (fluted) tubes to meet the tolerances required—in alloys suitable for the machining operations. Gillette tried the idea and now uses Anaconda special-shape tubes for handles of three models.

Long lengths of the tube are fed into high-speed, multiplespindle machines which automatically convert the tube to razor handles ready for the plating room. Production is greatly increased, rejects and waste material are reduced to a minimum, and the uniformity of the handles simplifies assembly. Most important of all to the Gillette Safety Razor Company is the improved quality of the finished product. Save Material and Production Costs: Special-shape seamless tubes—of copper, copper alloys or aluminum—in standard lengths, or cut to specified lengths, can save several steps in arriving at a finished product. The American Brass Company's French Small Tube Division are specialists in producing small tubes (up to ½" O.D.) of special design and, in addition to maintaining a wide range of stock dies, are ready to cooperate fully in the development of new shapes to meet specific requirements.

For Action: Contact our nearest District Sales Office or send a sample, drawing or description, estimated quantity, kind of metal required and other pertinent data to: The American Brass Company, French Small Tube Division, Waterbury 20, Conn.

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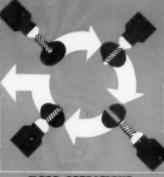
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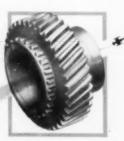
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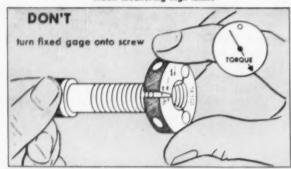
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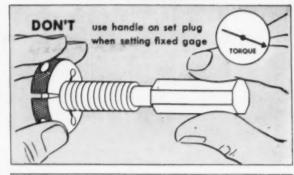
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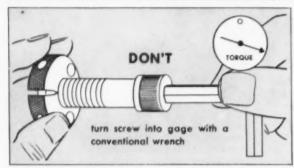
The following technical papers delivered at the Silver Anniversary Convention of the American Society of Tool Engineers, in Houston, March, 1957 are ready for immediate distribution.

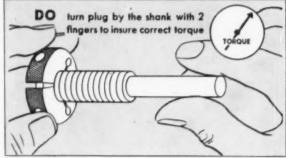
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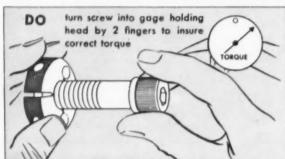
	The 'Why' of Registration and the Benefits Accruing	*22	Progress Report—Ceramic Cutting Tools Applied to Production Jobs
2	to Those Affected Registration—Industry's Point of View	*23	Analysis of Variables in Ceramic Tool Cutting
-	Labor Control Experience in Aircraft Repair	*24	Industrial Application of Ceramic Tools
4	Some Economics Aspects of Machine Tool Selection	†29	What are Plastics?
5	Project Vanguard—Launching the Man-Made Moon	130	What Properties are Available in Plastics?
6	Tool Engineering for Project Vanguard	131	The History of Plastic Tooling
7	Design for Machining High Temperature Alloys	†32	The Fabrication of Plastic Tools
8	Chip Breaking Characteristics of Titanium	133	Tool Applications of Plastic Materials
9	Residual Stresses from Machining Operations	†34	What are the Known Limitations of Plastic Tools?
10	Stress and High Temperature in Grinding	†35	Can Plastic Tools be Repaired and Modified?
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*20	A Comparison of Workpiece Finish Produced by	†38	
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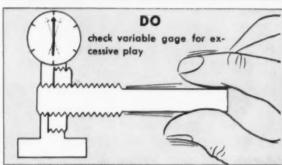












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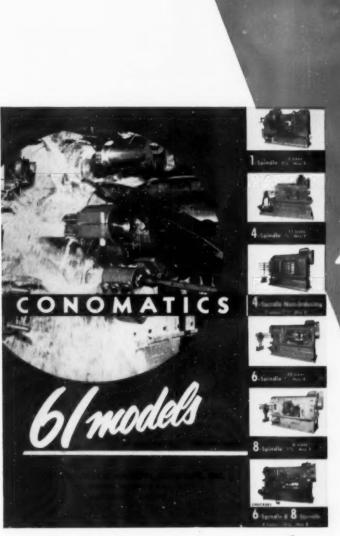
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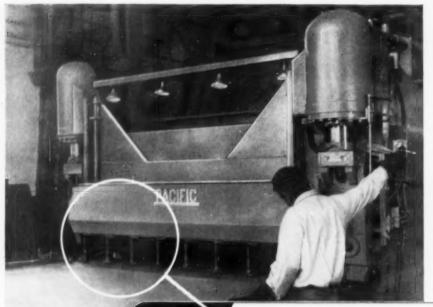
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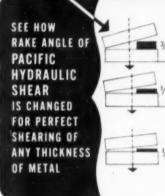


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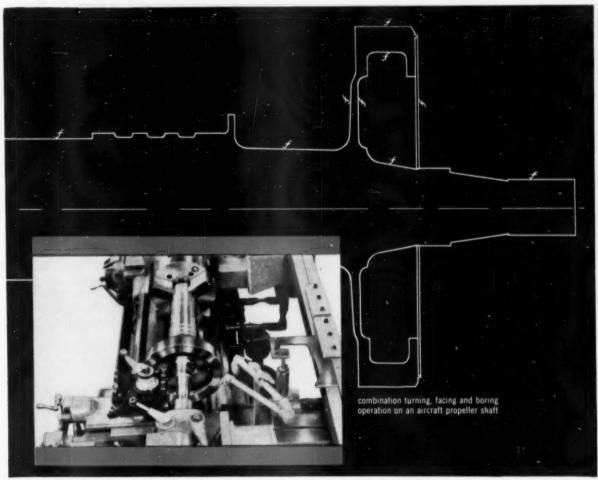
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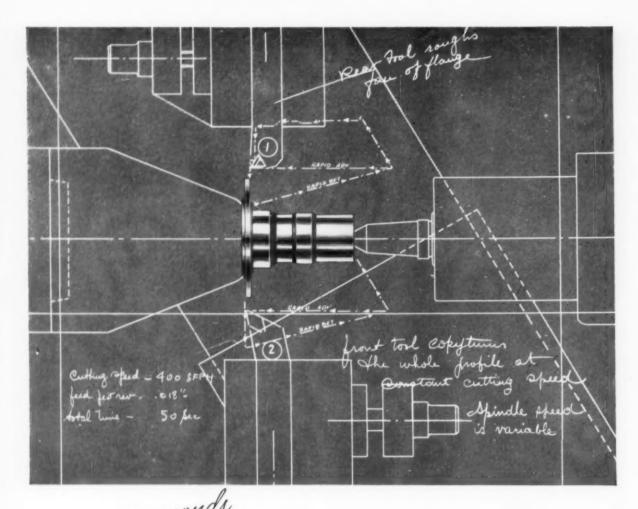
The machining of complex contours on the periphery, bore or face of a workpiece is the job for which the Lodge & Shipley DUAL TRACER was perfected. In addition to this facility, the DUAL TRACER can handle conventional tracing jobs or can be changed over almost instantly to standard lathe operation. This versatility removes the DUAL TRACER from the limited use that makes the "special lathe" an uncertain investment.

Chances are the DUAL TRACER can do your job faster and more economically. Consult our

sales engineering department. For details, write: The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.



your LODGE-ical choice ...



the Conomatic Pilot copyturns
this entire profile at constant cutting speed

The Conomatic Pilot is the only multicycling copying lathe that provides constant feed per revolution by means of a piloted hydraulic feed—an important reason why you can profile turn parts like this to very close tolerances on all surfaces at full production speeds. When used for finishing only, the Conomatic Pilot can often eliminate green grinding operations.

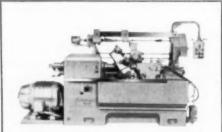
Write today for details of the Conomatic Pilot lathe.

# Conomatic

CONE AUTOMATIC MACHINE CO., INC., WINDSOR, VT.

PILOT DIVISION

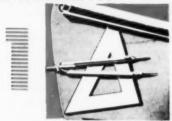
30 Rockefeller Plaza, New York 20, N. Y.



The Conomatic Pilot Model KU is a hydraulically-controlled multicycling copying lathe that can automatically reproduce practically any profile, using a motorized rotating template. It can be adapted to a wide variety of slides and tool stations.

# reasons for checking your Commercial Heat Treater First

HE PROVIDES . . .



Guidance in Steel Selection and Design



Metallurgical Understanding of Metal Properties



**Assistance in Proper Preparation** of Parts for Heat Treating





Knowledge through Experience of the Right Heat Treat for the Job



Extensive array of **Equipment and Facilities** 





Final laboratory and non-destructive Testing

Whenever your production requirements for a new product or the redesign or improvement of an old one mean the installation or expansion of heat treating activities, it will pay you to check with your Commercial heat treater before tackling the job yourself.

The 6 basic reasons for this are shown above Remember the Commercial Heat Treater has the skill, the experience, the equipment; — all under one roof ready to serve you.

#### THERE'S A HEAT TREATING SPECIALIST HEAR YOUR PLANT

American Metal

Anderson Steel Treating Co. Detroit, Michigan

B. & W. Heat Treating Ltd. Kitchener, Ontario, Canad

Benedict-Miller, Inc.

Bennett Heat Treating Co., Inc.

Commercial Metal Treating, Inc. Bridgeport, Conn.

Cook Heat Treating Co. of Texas

The Dayton Forging & Heat Treating Co.

Dominy Heat Treating Corp.

Drever Company Philadelphia 33, Pennsylvania

Greenman Steel Treating Company Worcester 5, Massachusetts

Fred Heinzelman & Sons

Alfred Heller Heat Treating Co.

New York 38, New York Hallywood Heat Treating Co.

Los Angeles 38, Califor Ipseniab of Canada Ltd.

L-R Heat Treating Company

The Lakeside Steel Improvement Co.

Cleveland 14, Ohio Metallurgical, Inc.

Metallurgical, Inc.
Kansas City 8, Missouri

New England Metallurgical Corp.

Paulo Products Company St. Louis 10, Missouri

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Pittsburgh Metal Processing Co.

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# **APEX** TOOLS

# INSERTED-BLADE MILLING CUTTERS AND SINGLE-POINT TOOLS FOR ALL METAL-CUTTING NEEDS

In the Apex line, metal workers, especially in heavy industries, can have a very wide choice of types and sizes of cutters, with blades tipped with carbide, H. S. S., Stellite or Cobalt. The cutters shown here merely indicate the breadth of the Apex line. Our new catalog shows all. Send for one, it belongs in your equipment.

#### Thin, Alternate-Angle Cutter

Free cutting, for slots and keyways. Any width from 3/16"; diameters from 3" up. Drop-forged blades, adjustable to maintain width if desired. Also made with full radius, and in interlocking style as well.









Apex offers milling cutters for many jobs. Above is shown one that takes a big chip fast! Made in diameters from B" to 24". Cutters also available for lighter work of various types.



Shown at left is one of the famous Apex Shankless, Adjustable, Serrated, Single-Point Tools. Holders are available for every metal-removing job, with numerous standard-shape tool bits to choose from.





Apex bits of the type shown above will fit most standard tool holders.

Apex holders for round-shank tool bits are available in all sizes for all jobs. The tools are furnished ground, ready to use.

#### APEX TOOL & CUTTER CO., INC.

SHELTON 16, CONNECTICUT USE READER SERVICE CARD; INDICATE A-10-300-1

# Gee THE DIFFERENCE THE ZIEGLER MAKES!



On tapping and reaming jobs you'll find that there's a big difference between the Ziegler Tool Holder and ordingry tool holders in the quality of work turned out.

This is because the Ziegler automatically corrects inaccuracies in set-up up to, as much as  $\frac{1}{21}$ " on the radius or  $\frac{1}{21}$ " on the diameter.

Get a Ziegler Holder and see how it will not only simplify the work of making set-ups but also reduce your spoilage losses.

PROMPT DELIVERY

W. M. ZIEGLER TOOL COMPANY

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FORTING HOLDER

USE READER SERVICE CARD; INDICATE A-10-300-2

### **TAPPING TROUBLES?**



Royco Precision Ground Taps are engineered for your particular job.

Royco Taps are ground entirely between centers using precise machines and tooling. High quality is not sacrificed for mass production methods.

Royco stocks a large supply of special taps ready for immediate delivery plus a complete line of standard taps and thread gages. All types are ground — including acme, square thread, buttress etc.



Send for catalog today.



Service Will Save You Money

Royco Tap & Tool Corp.

PHONE 7210
BOX 2688 NORTH FRANCH, MICH



USE READER SERVICE CARD; INDICATE A-10-300-3

The Tool Engineer

There is no quartz in diabase or gabbro, the so-called black granite. Instead, the hardest mineral in such surface plates is feldspar and that is present in smaller quantities than horn-

blende, an even softer mineral making up the bulk of "black

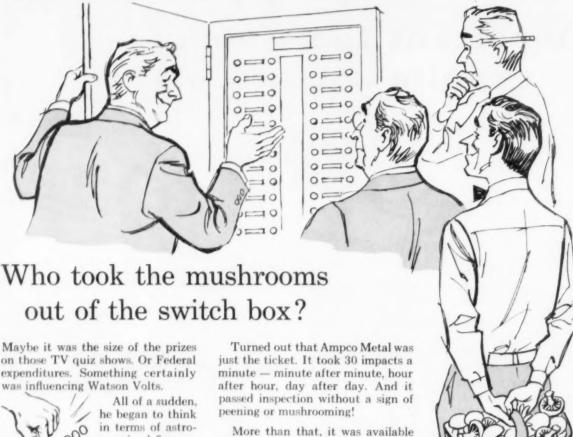
granite."

Quartz, when finished, is the least abrasive of all minerals in rock. Of all the minerals found in igneous rock, quartz is the hardest, smoothest, most durable and wear resistant. Its non-abrasive quality is desirable for protection of fine precision tools and instruments sliding across the surface of a plate.

In contrast to "black granite" surface plates, Herman's true granite surface plates contain approximately 30% quartz. This gives you the advantages of the most desirable mineral balance-assures you of long lasting precision and economy! Write for full details today.



Any similarity to a real-life company is purely intentional



he began to think in terms of astronomical figures. Told his production people that he wanted a new

bumper for their electrical switch box. One that would take 20,000,000 (yep, that's right — twenty million) impacts! And do it without appreciable wear!

Like the hermit who saw a giraffe for the first time, the production manager said.

"There ain't no such animal!" Suspecting, of course, that he'd eventually find that there was. Which he did.



Somewhere along the line, A Samaritan told the p.m. about Ampco Metal. About how it is a whole series of uniform-quality copper-base alloys engineered to meet a wide range of special-duty requirements.

More than that, it was available as extruded solid rod in a stock size that closely paralleled requirements. And it took less machining time.

Everything was under control - including costs!

Ampco Metal extruded solid rounds combine high strength and hardness with exceptional resistance to wear, fatigue, and corrosion.

Companies in many fields regularly use extruded solid rods of Ampco Metal — for bearings, bushings, worms, gears, and other vital parts.

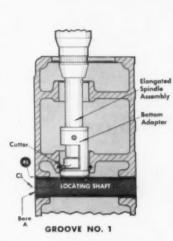
Your Ampco stocking distributor can supply diameters from ½" to 5½". Call him for prompt service. If you don't know who he is, write us for his name. Ampco Metal, Inc., Dept. TE-10, Milwaukee 46, Wis. (West Coast Plant: Burbank, Calif.)

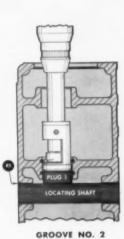
### AMPCO® METAL

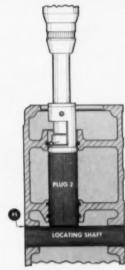
The metal without an equal

# Waldes Truarc Grooving Tool pays for itself with big savings on one small run!

3 internal recesses cut in bores of 100 castings in 17.5 hours...including set-up time







GROOVE NO. :

The job shown above called for three grooves located at prescribed distances from center-line CL of bore A. Depth and location tolerances: ±.0015".

Size and shape of the castings made nesting difficult for a boring bar operation. Exterior surfaces were unmachined, making alignment complicated. With two grooves over 7" from the housing's open end, boring bar chatter could have caused costly rejects.

To overcome these obstacles a Waldes Truarc Grooving Tool was equipped with an elongated spindle assembly and bottom adaptor. The tool was mounted in a drill press, the castings in a large vise. Grooves were then cut as follows:

**Groove No. 1:** A locating shaft was inserted into bore A as a reference surface and the tool piloted into the housing until the bottom adaptor banked on the shaft. The tool is designed so that the cutter rotates in

a neutral position until additional downward pressure is applied. It then moves into cutting position until preset groove depth is reached, after which the tool idles. Release of pressure returns the cutter to neutral so that the tool may be withdrawn.

**Groove No. 2:** Plug 1 was inserted into the bore over the locating shaft and the tool again piloted into the bore. The groove was then cut the same way as Groove No. 1.

**Groove No. 3:** Plug 2 was substituted for the first plug and the cutting operation repeated.

All 300 grooves were held to prescribed tolerances. Set-up time: exactly 11 minutes. Operating time: 1050 minutes for 100 castings. Rejects: none!

No recessing problem is too tough for the amazingly versatile Waldes Truarc Grooving Tool. It's so simple even unskilled labor can use it accurately.

Write for a 20-page manual containing full information on Waldes Truarc Grooving Tool.



WALDES

# TRUARC

GROOVING TOOL

U.S. Pat. 2,411,426.

WALDES KOHINOOR, INC., 47-16 Austel Place, L.I.C. 1, N.Y.



Waldes	Kohinoor	, Inc.	
47-16 A	ustel Pl.	L. L. C.	1. N. Y

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool.

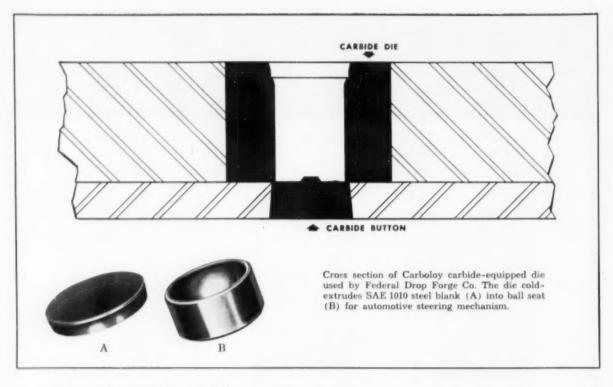
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Company

Company

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Cold-extruding 1010 steel ball seats . . .

# AN EXTRA DAY'S OUTPUT EVERY 3 DAYS WHEN CARBOLOY DIES REPLACED STEEL

Carboloy cemented carbides are harder than steel—and far more resistant to wear. That's why carbide-equipped cold-extrusion dies save an average of 2½ hours of press downtime per shift at Federal Drop Forge Co., Lansing, Michigan.

When steel dies were used, they were polished each shift . . . and the button (see diagram) had to be reground. Time lost: 2½ hours per shift, or the equivalent of one working day every three days. Steel die life averaged 25,000 pieces; steel buttons produced about 15,000 pieces per grind.

Now that Carboloy carbide dies and buttons are used, only occasional polishing is required. One die has produced almost 1 million extrusions in 2½

years with only .0003" wear . . . and carbide button life averages 2 million pieces.

In addition to longer die life, a costly centerless grinding operation was eliminated because, with carbide dies, specified tolerances are held from beginning to end of the run. And, the surface finish after extrusion is better than previous centerless-ground finish.

The unique properties of Carboloy cemented carbides can be used just as effectively on drawing, forming, or blanking operations. Check with your diemaker for more information. Or write: Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Ave., Detroit 32, Michigan.







reamers

shoulder and bottom, in less than 2 min.

combination boring heads multi-diam tools trepanning tools form cutters gang mills

At the Waterbury plant of Vickers Incorporated, machine time is drastically reduced with this special O K carbide head for boring and counterboring cast iron hydraulic pump bodies. A single plunging cut completes four operations at the same time. You can buy similar O K multiple-operation tools, boring heads, reamers, trepanning tools, gang mills for \$150.00 to \$200.00. An investment that pays for itself many times over, generally the first week the tool is on the job. Engineering service is free. Write for Book of 50 Engineering Prints of Multi-diam Tools.



modern milling cutters for modern milling machines

THE OK TOOL COMPANY, INC. • 300 Elm Street • Milford, New Hampshire





Catalog G-57 presents basic data on all types of Verson presses. Write for your copy.

Die tryout for a tool and die shop is probably one of the severest tests of the versatility of a press. At Westlof Tool & Die Co., Detroit, Michigan, a 300 ton Verson double crank, straight side press is used for this purpose.

The press itself incorporates several features which are examples of the versatility Verson engineering can provide: The ram is equipped with three triple bank cushions adjustable right or left to 7" centers. The bed has two large cushions, one right, one left. All cushions are independently controlled. The press is equipped for application of coil feeding equipment should it become necessary. Press speed is variable from 15 to 30 strokes per minute. Power adjustment of the slide is 15".

If your requirements call for great versatility, bring your problem to Verson. For specific recommendations, just send an outline of your needs.

A Verson Press for every job from 60 tons up.



ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

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N THE field of vibratory parts feeders, PEECO'S leadership stands unchallenged. Manufacturers of production equipment for various markets are finding that PEECO'S engineering knowledge in small parts feeding is helping them increase the capacities of new production equipment. One of the many companies in the production field now being served by PEECO is the established name of Ingersoll-Rand.

If you want to produce more, send for bulletin #653 and ask for the name of the PEECO representative in your area.

THE WORLD'S LARGEST

EXCLUSIVE MANUFACTURER

OF VIBRATORY PARTS FEEDERS

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PERRY EQUIPMENT & ENGINEERING CO.

ERIE, PA. . . . DIVISION OF AUTOMATION DEVICES, INC.



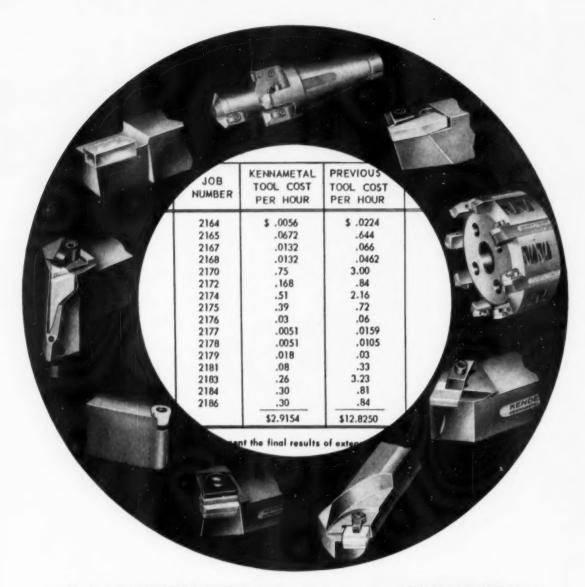
Ingersoll-Rand

includes DEVELOPED PEECO FEEDERS

The Ingersoll-Rand Model FSD4A1 (illustrated)

feeds and drives eight self-tapping hex head screws for automobile radiator grille assembly. Completed cycle for this quality controlled, time saving operation is accomplished in less than one-

half of the time formerly required.



# It took KENNAMETAL\* Tooling—plus KENNAMETAL Tool Engineering Service—to get these results!

There's nothing much that words can add to the story told by the comparative cost figures above. On sixteen separate applications, Kennametal tool cost per hour (center column) totaled \$2.9154—less than one-fourth as much as the \$12.8250 cost for tools previously used (right hand column).

On this basis, the Kennametal tool cost of \$17,490 per year cut previous expense by \$59,460!

It takes a combination of quality

tools and scientific service to produce results like this. Kennametal has built its business upon this combination.

A Kennametal Tool Engineer will work with your personnel, in analyzing various machining jobs to get the best results on each operation. The extensive selection of standard Kennametal tooling usually provides the exact tool needed to handle the work . . . if not, he can make the proper recommendations.

When desirable, in-plant training courses can be conducted by Kennametal representatives to help your personnel in the selection, application and care of tools to get the most from your tool dollars.

We will be glad to give you full information on how Kennametal tools and Kennametal service can help you. Just write, outlining your particular problem, to Kennametal Inc., Latrobe, Pennsylvania.

\*TRADEMARK

G-2008





KENNAMETAL ... Partners in Progress





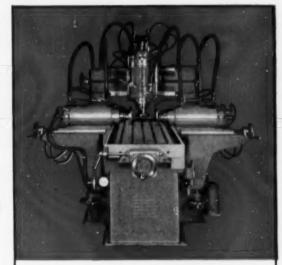
PROOF of the tremendous productivity of Onsrud milling machines designed for nonferrous milling is shown by this production study. This kind of production is typical of the advantages that can be yours with every

Onsrud milling machine.

THE PART: Outboard motor cylinder block, aluminum alloy casting 7" wide x 13" long and 6" high.

THE MACHINE: Onsrud A-242S Tri-Way Milling Machine with one vertical and two horizontal opposed milling heads.

OPERATION: Machine three sides of block in on set-up and in one pass.



Onsrud A-242S Tri-Way Milling Machine, for milling up to three sides at one time, of any part square or rectangular in cross section. Planer type table with variable feed up to 258 IPM. Cutter motors Onsrud 10 HP, 3,600 RPM, liquid cooled.

**ACCURACY:** Flatness tolerance ± 0.0003". Parallel tolerance ± 0.001".

PRODUCTION: Three parts per minute.

CUTTER LIFE: 500 to 1,000 parts per regrind.

Onsrud high speed milling production is only possible because Onsrud machines are designed and built specifically for milling aluminum and related nonferrous metals. The cutter speeds and feeds are exactly right to give smooth finish and precision . . . at super-high production speeds.



Let us give you complete data on the Onsrud A-242S Tri-Way Milling Machine...and all other Onsrud milling machines for nonferrous metal milling. Get the facts on these proved, high speed production machines. Your inquiry is cordially invited.

### ONSRUD

MCHINE WORKS, INC

7726 Lehigh Avenue Niles 31, Illinois (SUBURB OF CHICAGO)



HIGH SPEED MILLING MACHINES FOR ALUMINUM AND RELATED HONFERROUS METAL MILLING .

For doing things better by doing things differently!

# Here's how you can drill or tap OVER A MILLION DIFFERENT HOLE COMBINATIONS on any drill press in any operating position!



Universal Ball Joint
Adjustable Spindle
MULTIPLE DRILLING
AND
TAPPING HEADS





Model 600 (6-spindle circle type) head set up for drilling on a standard drill press — one of three models, circle or straight line types.

#### Featuring Ettco's exclusive

#### Lubricated Ball Joint with Neoprene Covers

These unusually versatile, smooth-running heads give you the dependable, high-production accuracy needed for most small hole drilling and tapping operations. Glance at some of the built-in advantages that make these compact light weight heads such an outstanding development:

Wide range of spindle settings: Fast and easy to locate in almost any pattern, even while running. Excellent rigidity, too.

Add or remove spindles quickly: That's because they're keyed into the gear case. They're interchangeable on all three models.

Tap or drill capacities up to 5/16" in steel: Each spindle capable of transmitting 1/2 H.P.

1:1 ratio of drive to spindle: Ideal for production tapping.

No reversing motor needed: Attach to any drill press with standard Ettco face plate — they're ready to work without special engineering.

Long trouble-free service: Durable chromenickel spindles are one-shot lubricated and run in oilite bushings for smoothest performance.

And 100% guaranteed to do the job they're made for!

Want more details? Write today for bulletin 600B. Authorized Ettco distributors throughout the U. S. and Canada

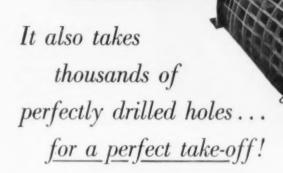
The only full-line manufacturer of drilling and tapping equipment for the entire small hole field

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TAPPING ATTACHMENTS . MULTIPLE HEADS . STANDARD AND SPECIAL DRILLING & TAPPING UNITS AND MACHINES . INDEXING FIXTURES



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### NEW YORK TWIST DRILLS

By producing thousands upon thousands of clean, concentric holes without burrs — and more holes for every dollar, New York Twist Drills play an important part in the construction of the sleek new XP6M-1 SeaMaster and other Martin aircraft. Their own performance tests prove New York Drills are straight and true, with accurate points and extra smooth flutes.

We've been a major supplier of twist drills to this famous company for a number of years, now. Among the New York drills used in the Martin plants are our aircraft extension types, 6" and 12", adapter drills, stack drills, drills for stainless steel, 75 ST aluminum and titanium.

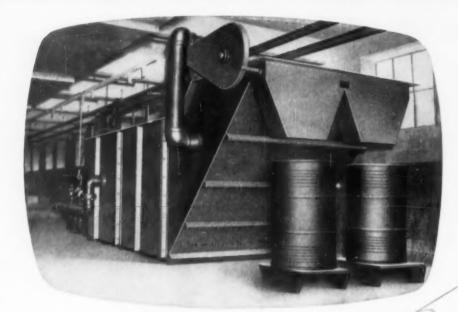
You can depend upon New York drills to do a quality job and save at least 20% on your twist drill bill, too. Other featured types are Knockout drills for aluminum, stainless steel and titanium rivets; Types A, B & C twist drills — National Aircraft Standards Specifications.

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PAY THEIR WAY
AT
UNION TWIST DRILL
COMPANY

Note: Union Twist Orill recently increased their plant capacity and naturally added a second Hollman Magnatla Separator for laster volume production.

how

HOFFMAN

MAGNAFLO

SEPARATORS eliminated



before

the installation of a Hoffman Magnaflo Separator at the Union Twist Drill Co. plant in Athol, Massachusetts, these were some of the problems encountered in the use of cutting oils and coolants:

- Contaminated oil interfered with production quality, resulting in numerous rejects.
  - 2—Heavy sludge hampered grinding wheels, requiring frequent dressing.
    - 3-Dirty cutting oil was discarded.
      - 4-Maintenance costs were high.
  - 5—Considerable down-time was required for cleaning.

after

- a Hoffman Magnaflo Separator for the removal of metal particles from oils and coolants was installed, these time and money saving clarification improvements were noted:
- I-Clean oil cut rejects to a minimum.
- 2—With the need for constant wheel grinding eliminated, wheel-life was extended.
- 3-Oil could be used over and over again.
- 4—The Magnaflo Separator required virtually no maintenance.
- 5-Down time was reduced to a minimum.

HOFFMAN MAGNAFLO SEPARATORS

custom designed for your needs

We'll be glad to make a survey of clarification problems in your plant. No obligation, of course Write for Magnaflo Separator Catalog A.860, which is devoted exclusively to the removal of ferrous material from cutting oils and water soluble coolants.

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Other industrial equipment – by Hoffman: AIR APPLIANCE DIVISION, Multistage Centrifugal Blowers & Exhausters –
Industrial Vacuum Cleaning, Portable and Stationary Systems – PNEUMATIC CONVEYING DIVISION – Custom Built Systems

# THE LITTELL

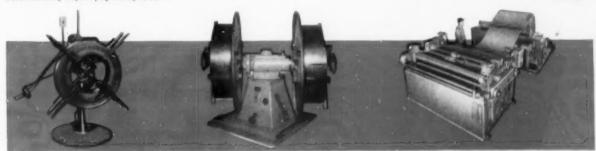
#### INCLUDES REELS FOR 100 LB. TO 40,000 LB. COILS

Your Littell Reel is easy to load. It holds the stock secure, and unreels it smoothly, with controlled action. You can depend on accurate pay-off to automatic feeding equipment, or to press, shear or slitter. For Littell Reels are part of the complete Littell coil handling line . . . Hooks, Straighteners, Roll Feeds, Coil Cradles, Sheeting Lines . . . the line that is proved by 39 years of press room



FOR 40,000 POUND COILS LITTELL No. S400 Automatic Centering Reel

Showing loading car carrying coil to reel. Supporting arms of reel are hydraulically expanded. Variable speed motor controls automatically adjust pay-off speeds.



FOR 100 TO 1000 LB. COILS LITTELL No. 3-G and 5-G

These smooth-running, ball bearing, Automatic Centering Reels uncoil stock or wind scrap. Reversible motor.

FOR 2500 POUND COILS LITTELL No. 25-12 Double Plain Brake Reel Keeps one coil in reserve as it unreels stock Easily swivelled to lock the reserve coil in unreeling position.

FEEDING AND STRAIGHTENING MACHINE WITH COIL CRADLE

Straightens and feeds stock .125" thick x 72" wide at speeds up to 180 f.p.m. Driven through hydraulic drive transmission by a 25 h.p. motor.



ROLL FEEDS-REELS-STRAIGHTENING
AND FEEDING MACHINES-COIL
CRADLES-SHEETING LINES
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LITTELL CATALOG 56 gives details on the complete Littell line write for your copy.

# **Hollow Mill Maker finds**



HARD, TOUGH and VERSATILE







### Write For Copy of "CUTTING TOOL MATERIALS"

This 36-page illustrated booklet analyzes and compares types and covers grade selection for all major classes of cutting tools, etc., invaluable data for production men. Write for your copy today.

ADDRESS DEPT. TE-94

The maker of these adjustable hollow mills required a steel that would give top performance in a variety of jobs—turning, tapering, facing, chamfering and trepanning. After thorough testing, Allegheny Ludlum's high speed DBL-2 was selected.

DBL-2 is an improved general-purpose high speed steel. It contains tungsten, molybdenum and vanadium in such proportions that it excels 18-4-1 for most applications. DBL-2's unusual combination of high hardness with toughness, its ability to hold a fine grain over a wide hardening range, and the fact that it easily machines many diverse types of stock, made it particularly well suited for this job.

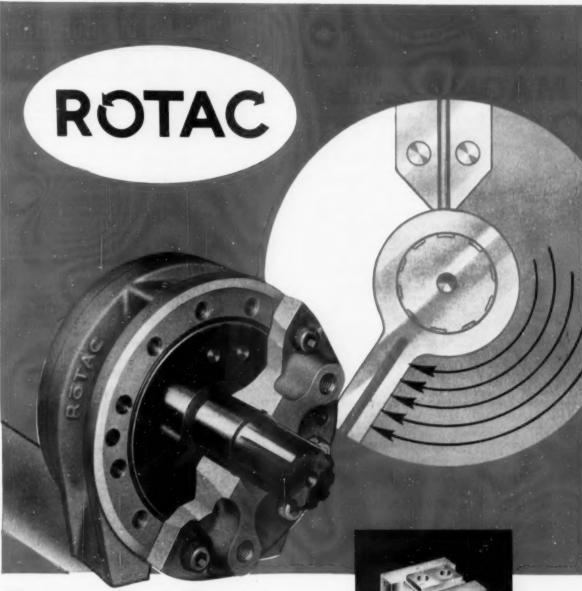
In addition to these advantages, DBL-2 can be heat treated in the same furnaces and atmospheres as 18-4-1 without fear of harmful decarburization. These DBL-2 blades were heated to 2250 F., oil quenched and drawn twice at 1025 F. After heat treatment, blades easily machined such stock as aluminum, stainless steel, carbon steel, aircraft steel, plastics, bronze, screw stock, cast iron and brass.

There is an A-L tool steel to meet your toughest requirements. For further information call your A-L representative or distributor today, or write . . . . Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.

For negrest representative, consult Yellow Section of your telephone book.

For complete MODERN Tooling, call Allegheny Ludlum





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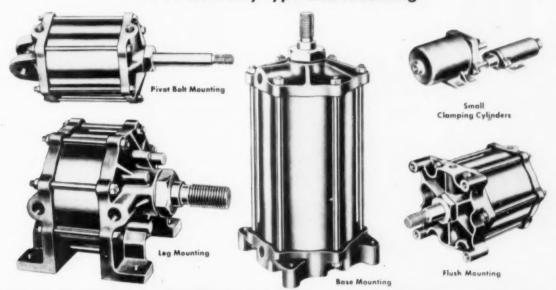
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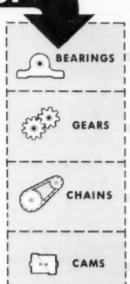
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Strong-Carlisle-Hammond         228           Magna-Driver Corp.         316           *Mall Tool Co., Division,         269           Remington Arms Co., Inc.         269           *Manhattan Rubber Division,         10           Raybestos-Manhattan, Inc.         10           Marshall Steel Co.         209           *McCrosky Tool Corp.         165           Melin Tool Co., Inc.         196           *Metal Carbides Corp.         288           Metal Treating Institute         299           *Metallurgical Products Department,         General Electric Corp.         304           *Meyers, W. F., Co.         316           *Micrometrical Mfg. Co.         198           *Milford Rivet & Machine Co., The         187           *Milford Rivet & Machine Co., The         187           *Miller, Harry, Corp.         278           *Moore Special Tool Co.         188	Walker-Turner Division       249         &Royco Tao & Tool Co.       300         *Russell, Holbrook & Henderson, Inc.       257         *Ryerson, Jos. T. & Son, Inc.       72         S         Sandvik Steel Co., Coromant Division       152         Scherr. Geo., Co.       258         *Schrader's, A., Son       317         Seneca Falls Machine Co.       220         *Service Machine Co.       284         *Severance Tool Industries, Inc.       323         *Shell On Machine Co.       156         Shell Chemical Corp.       259         *Shell Oil Co.       222         Sidney Machine Tool Co.       236         *Simonds Saw & Steel Co.       256         *Simonds Saw & Steel Co.       256         *Simplex Machine Tool Corp.       214
Strong-Carlisle-Hammond   228	Walker-Turner Division       249         &Royco Tao & Tool Co.       300         *Russell, Holbrook & Henderson, Inc.       257         *Ryerson, Jos. T. & Son, Inc.       72         \$         Sandvik Steel Co., Coromant Division       152         Scherr. Geo., Co.       258         *Schrader's, A., Son       317         Seneca Falls Machine Co.       220         *Service Machine Co.       284         *Severance Tool Industries, Inc.       323         *Shell On Machine Co.       156         Shell Chemical Corp.       259         *Shell Oil Co.       222         Sidney Machine Tool Co.       236         *Simonds Saw & Steel Co.       256         *Simonds Saw & Steel Co.       256         *Simplex Machine Tool Corp.       214         *Simplex Machine Tool Corp.       214         *Simplex Refining Co.       271
Strong-Carlisle-Hammond   228	Walker-Turner Division       249         kRoyco Tap & Tool Co.       300         "Russell, Holbrook & Henderson, Inc.       257         "Ryerson, Jos. T. & Son, Inc.       72         \$         Sandvik Steel Co., Coromant Division       152         Scherr, Geo., Co.       258         "Schrader's, A., Son       317         Seneca Falls Machine Co.       220         "Service Machine Co.       284         "Severance Tool Industries, Inc.       323         "Sheldon Machine Co.       156         Shell Chemical Corp.       259         "Shell Oil Co.       222         Sidney Machine Tool Co.       236         "Simonds Saw & Steel Co.       256         "Simonds Saw & Steel Co.       256         "Simplex Machine Tool Corp.       214         Sinclair Refining Co.       271         "Skinner Chuck Co., The       282
Strong-Carlisle-Hammond         228           Magna-Driver Corp.         316           *Mall Tool Co., Division,         269           *Manhattan Rubber Division,         10           Raybestos-Manhattan, Inc.         10           Marshall Steel Co.         209           *McCrosky Tool Corp.         165           Melin Tool Co., Inc.         196           *Metal Carbides Corp.         288           Metal Treating Institute         299           *Metallurgical Products Department,         299           *Metallurgical Products Department,         304           General Electric Corp.         304           *Moreometrical Mfg. Co.         198           *Milford Rivet & Machine Co., The         187           *Miller Fluid Power Division,         Flick-Reedy Corp.         17-20           Miller, Harry, Corp.         278           *Moore Special Tool Co.         188           Morris, Robert E. Co.         179           Morse Twist Drill & Machine Co.,         Subsidiary Van Norman Industries, Inc.         24-25	Walker-Turner Division       249         kRoyco Tap & Tool Co.       300         *Russell, Holbrook & Henderson, Inc.       257         *Ryerson, Jos. T. & Son, Inc.       72         S         Sandvik Steel Co., Coromant Division       152         Scherr. Geo., Co.       258         *Schrader's, A., Son       317         Seneca Falls Machine Co.       220         *Service Machine Co.       284         *Severance Tool Industries, Inc.       323         *Shell On Machine Co.       156         Shell Chemical Corp.       259         *Shell Oil Co.       222         Sidney Machine Tool Co.       236         *Simonds Saw & Steel Co.       256         *Simonds Saw & Steel Co.       256         *Simplex Machine Tool Corp.       214         *Sinclair Refining Co.       271         *Skinner Chuck Co., The       282         Smith & Mills Shaper Division,
Strong-Carlisle-Hammond   228	Walker-Turner Division         249           &Royco Tao & Tool Co.         300           *Russell, Holbrook & Henderson, Inc.         257           *Ryerson, Jos. T. & Son, Inc.         72           \$           Sandvik Steel Co., Coromant Division         152           Scherr. Geo., Co.         258           *Schrader's, A., Son         317           Seneca Falls Machine Co.         220           *Service Machine Co.         284           *Severance Tool Industries, Inc.         323           *Shell On Machine Co.         156           Shell Chemical Corp.         259           *Shell Oil Co.         222           Sidney Machine Tool Co.         236           *Simonds Saw & Steel Co.         256           *Simonds Saw & Steel Co.         256           *Simplex Machine Tool Corp.         214           Sinclair Refining Co.         271           *Skinner Chuck Co., The         282           Smith & Mills Shaper Division,         Nebel Machine Tool Co.         258
Strong-Carlisle-Hammond         228           Magna-Driver Corp.         316           *Mall Tool Co., Division,         269           *Manhattan Rubber Division,         10           Raybestos-Manhattan, Inc.         10           Marshall Steel Co.         209           *McCrosky Tool Corp.         165           Melin Tool Co., Inc.         196           *Metal Carbides Corp.         288           Metal Treating Institute         299           *Metallurgical Products Department,         299           *Metallurgical Products Department,         304           General Electric Corp.         304           *Moreometrical Mfg. Co.         198           *Milford Rivet & Machine Co., The         187           *Miller Fluid Power Division,         Flick-Reedy Corp.         17-20           Miller, Harry, Corp.         278           *Moore Special Tool Co.         188           Morris, Robert E. Co.         179           Morse Twist Drill & Machine Co.,         Subsidiary Van Norman Industries, Inc.         24-25	Walker-Turner Division         249           kRoyco Tap & Tool Co.         300           "Russell, Holbrook & Henderson, Inc.         257           "Ryerson, Jos. T. & Son, Inc.         72           \$           Sandvik Steel Co., Coromant Division         152           Scherr, Geo., Co.         258           "Schrader's, A., Son         317           Seneca Falls Machine Co.         220           "Service Machine Co.         284           "Severance Tool Industries, Inc.         323           "Sheldon Machine Co.         156           Shell Chemical Corp.         259           "Shell Oil Co.         222           Sidney Machine Tool Co.         236           "Simonds Saw & Steel Co.         256           "Simonlex Saw & Steel Co.         256           "Simplex Machine Tool Corp.         214           Sinclair Refining Co.         271           "Skinner Chuck Co., The         282           Smith & Mills Shaper Division,         Nebel Machine Tool Co.         258           Sossner Tap & Tool Co.         177
Strong-Carlisle-Hammond   228	Walker-Turner Division         249           kRoyco Tap & Tool Co.         300           "Russell, Holbrook & Henderson, Inc.         257           "Ryerson, Jos. T. & Son, Inc.         72           S           Sandvik Steel Co., Coromant Division         152           Scherr. Geo., Co.         258           "Schrader's, A., Son         317           Seneca Falls Machine Co.         220           "Service Machine Co.         284           "Severance Tool Industries, Inc.         323           "Shell On Machine Co.         156           Shell Chemical Corp.         259           "Shell Oil Co.         222           Sidney Machine Tool Co.         236           "Simonds Saw & Steel Co.         256           "Simonds Saw & Steel Co.         256           "Simplex Machine Tool Corp.         214           Sinclair Refining Co.         271           "Skinner Chuck Co., The         282           Smith & Mills Shaper Division,         Nebel Machine Tool Co.         258           Sossner Tap & Tool Co.         177           South Bend Lathe Works         284
Strong-Carlisle-Hammond   228	Walker-Turner Division         249           & Royco Tao & Tool Co.         300           *Russell, Holbrook & Henderson, Inc.         257           *Ryerson, Jos. T., & Son, Inc.         72           S         *Sandvik Steel Co., Coromant Division         152           Scherr. Geo., Co.         258           *Schrader's, A., Son         317           Seneca Falls Machine Co.         220           *Service Machine Co.         284           *Severance Tool Industries, Inc.         323           *Shell On Machine Co.         156           Shell Chemical Corp.         259           *Shell Oil Co.         222           Sidney Machine Tool Co.         236           *Simonds Saw & Steel Co.         256           *Simonds Saw & Steel Co.,         4           Heller Tool Co. Subsidiary         250-251           *Simplex Machine Tool Corp.         214           Sinclair Refining Co.         271           *Skinner Chuck Co., The         282           Smith & Mills Shaper Division,         Nebel Machine Tool Co.         258           Sossner Tap & Tool Co.         177           South Bend Lathe Works         284           *S-P Mfg. Corp.         197
Strong-Carlisle-Hammond   228	Walker-Turner Division         249           & Royco Tao & Tool Co.         300           ° Russell, Holbrook & Henderson, Inc.         257           ° Ryerson, Jos. T. & Son, Inc.         72           \$           Sandvik Steel Co., Coromant Division         152           Scherr, Geo., Co.         258           ° Schrader's, A., Son         317           Seneca Falls Machine Co.         220           ° Service Machine Co.         284           'Severance Tool Industries, Inc.         323           ° Sheldon Machine Co.         156           Shell Chemical Corp.         259           ° Shell Oil Co.         222           Sidney Machine Tool Co.         236           ° Simonds Saw & Steel Co.         256           ° Simonds Saw & Steel Co.         256           ° Simolas Refining Co.         271           ° Skinner Chuck Co., The         282           Smith & Mills Shaper Division,         Nebel Machine Tool Co.         258           Sossner Tap & Tool Co.         177           South Bend Lathe Works         284           °S-P Mfg, Corp.         197           °Standard Gage Co., Inc.         252
Strong-Carlisle-Hammond   228	Walker-Turner Division         249           kRoyco Tap & Tool Co.         300           "Russell, Holbrook & Henderson, Inc.         257           "Ryerson, Jos. T. & Son, Inc.         72           S           Sandvik Steel Co., Coromant Division         152           Scherr. Geo., Co.         258           "Schrader's, A., Son         317           Seneca Falls Machine Co.         220           "Service Machine Co.         284           "Severance Tool Industries, Inc.         323           "Shell On Machine Co.         156           Shell Chemical Corp.         259           "Shell Oil Co.         222           Sidney Machine Tool Co.         236           "Simonds Saw & Steel Co.         256           "Simonds Saw & Steel Co.         256           "Simplex Machine Tool Corp.         214           Sinclair Refining Co.         271           "Skinner Chuck Co., The         282           Smith & Mills Shaper Division,         Nebel Machine Tool Co.         258           Sossner Tap & Tool Co.         177           South Bend Lathe Works         284           "S-P Mfg. Corp.         197           "Standard Gage Co., Inc.         252
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Strong-Carlisle-Hammond   228	Walker-Turner Division         249           kRoyco Tao & Tool Co.         300           *Russell, Holbrook & Henderson, Inc.         257           *Ryerson, Jos. T. & Son, Inc.         72           S           Sandvik Steel Co., Coromant Division         152           Scherr. Geo., Co.         258           *Schrader's, A., Son         317           Seneca Falls Machine Co.         220           *Service Machine Co.         284           *Severance Tool Industries, Inc.         323           *Sheldon Machine Co.         156           Shell Chemical Corp.         259           *Shell Oil Co.         222           Sidney Machine Tool Co.         236           *Simonds Saw & Steel Co.         256           *Simonds Saw & Steel Co.         256           *Simonlas Refining Co.         271           *Skinner Chuck Co., The         282           Smith & Mills Shaper Division,         Nebel Machine Tool Co.         258           Sossner Tap & Tool Co.         177           South Bend Lathe Works         284           *S-P Mfg. Corp.         197           *Standard Gage Co., Inc.         252           *Standard Pressed Steel Co.         199
Strong-Carlisle-Hammond   228	Walker-Turner Division         249           *Royco Tap & Tool Co.         300           *Russell, Holbrook & Henderson, Inc.         257           *Ryerson, Jos. T. & Son, Inc.         72           \$           Sandvik Steel Co., Coromant Division         152           Scherr. Geo., Co.         258           *Schrader's, A., Son         317           Sencea Falls Machine Co.         220           *Service Machine Co.         284           *Severance Tool Industries, Inc.         323           *Shell Gon Machine Co.         156           Shell Chemical Corp.         259           *Shell Oil Co.         222           Sidney Machine Tool Co.         236           *Simonds Saw & Steel Co.         256           *Simonds Saw & Steel Co.         256           *Simplex Machine Tool Corp.         214           Sinclair Refining Co.         271           *Skinner Chuck Co., The         282           Smith & Mills Shaper Division,         Nebel Machine Tool Co.         177           South Bend Lathe Works         284           *S-P Mfg. Corp.         197           *Standard Parts Co.         149           *Standard Pressed Steel Co.         19
Strong-Carlisle-Hammond   228	Walker-Turner Division         249           kRoyco Tap & Tool Co.         300           "Russell, Holbrook & Henderson, Inc.         257           "Ryerson, Jos. T. & Son, Inc.         72           \$           Sandvik Steel Co., Coromant Division         152           Scherr, Geo., Co.         258           "Schrader's, A., Son         317           Seneca Falls Machine Co.         220           "Service Machine Co.         284           "Severance Tool Industries, Inc.         323           "Sheldon Machine Co.         156           Shell Chemical Corp.         259           "Shell Oil Co.         222           Sidney Machine Tool Co.         236           "Simonds Saw & Steel Co.         256           "Simonds Saw & Steel Co.         256           "Simplex Machine Tool Corp.         214           Sinclair Refining Co.         271           "Skinner Chuck Co., The         282           Smith & Mills Shaper Division,         Nebel Machine Tool Co.         258           Sossner Tap & Tool Co.         258           Sossner Tap & Tool Co.         177           South Bend Lathe Works         284           "S-P Mfg. Corp.         197
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Strong-Carlisle-Hammond   228	Walker-Turner Division         249           *Royco Tap & Tool Co.         300           *Russell, Holbrook & Henderson, Inc.         257           *Ryerson, Jos. T. & Son, Inc.         72           S           Sandvik Steel Co., Coromant Division         152           Scherr, Geo., Co.         258           *Schrader's, A., Son         317           Seneca Falls Machine Co.         220           *Service Machine Co.         284           *Severance Tool Industries, Inc.         323           *Shell On Machine Co.         156           Shell Chemical Corp.         259           *Shell Oil Co.         222           Sidney Machine Tool Co.         236           *Simonds Saw & Steel Co.         256           *Simonds Saw & Steel Co.         256           *Simplex Machine Tool Corp.         214           Sinclair Refining Co.         271           *Skinner Chuck Co., The         282           Smith & Mills Shaper Division,         Nebel Machine Tool Co.         258           Sossner Tap & Tool Co.         177           Sounth Bend Lathe Works         284           *S-P Mfg. Corp.         197           *Standard Gage Co., Inc.         25
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Strong-Carlisle-Hammond   228	Walker-Turner Division         249           4Royco Tap & Tool Co.         300           *Russell, Holbrook & Henderson, Inc.         257           *Ryerson, Jos. T. & Son, Inc.         72           S           Sandvik Steel Co., Coromant Division         152           Scherr. Geo., Co.         258           *Schrader's, A., Son         317           Sencea Falls Machine Co.         220           *Service Machine Co.         284           *Severance Tool Industries, Inc.         323           *Shell On Machine Co.         156           Shell Chemical Corp.         259           *Shell Oil Co.         222           Sidney Machine Tool Co.         236           *Simonds Saw & Steel Co.         256           *Simonds Saw & Steel Co.         256           *Simplex Machine Tool Corp.         214           Sinclair Refining Co.         271           *Skinner Chuck Co., The         282           Smith & Mills Shaper Division,         282           Nebel Machine Tool Co.         258           Sossner Tap & Tool Co.         177           *Standard Gage Co., Inc.         252           *Standard Pressed Steel Co.         192           *St
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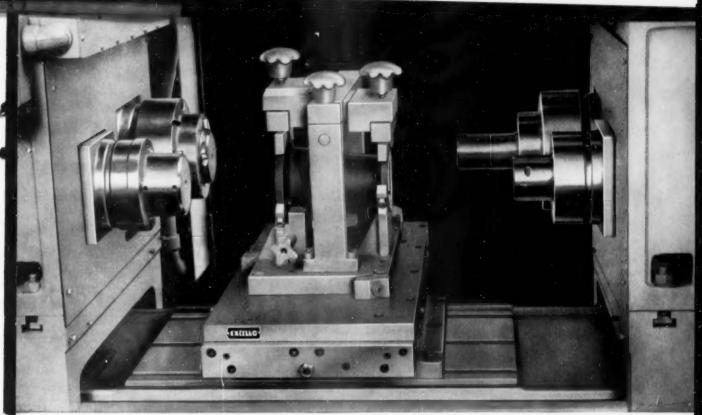


COLLET MANUFACTURING CO.

Cleveland 14, Ohio







One of several fixture arrangements used for machining valve parts.

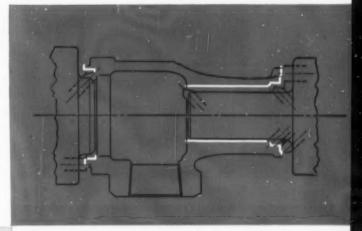
# **Fast and Flexible**

### SHORT RUN COST SAVER...

This Ex-Cell-O 17-A Precision Boring Machine rough bores, plunge faces, finish bores and chamfers a wide range of assorted cast-iron valve bodies and bases. Production schedules require relatively short runs of each size, so the tooling shown here has set blocks to accommodate the various parts.

Designed for medium and large size workpieces, the double-end 17-A Precision Boring Machine can handle identical operations at either end; rough at one end, finish at the other; or perform an entirely different operation at each end. So you can see the cost-saving versatility of this two-in-one machine.

Perhaps slow changeovers are inflating your production costs. If so, why not call your Ex-Cell-O Representative or contact Ex-Cell-O in Detroit.



White lines represent cuts made on a typical part.



Here are a few sizes of the valve bedies and bases processed on the Style 17-A Machine.



Machinery Division



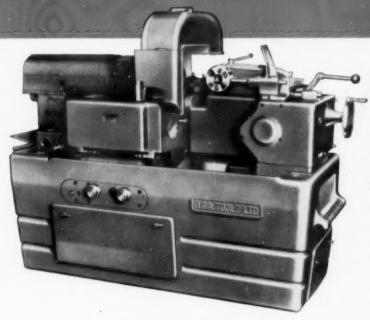
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# first to provide UNIT REPLACEMENT of parts subjected to most wear

to keep important production flowing with new machine performance



Additional Production Advantages of BSA

FIVE STANDARD CAPACITIES: 1/2"

WIDE RANGE OF SPINDLE SPEEDS—200 to 6000 on ½" machine, 69 to 1260 on 2" model.

Cams, change gears and tooling easily accessible FOR QUICK JOB-TO-JOB CHANGEOVER.

Unit construction provides quick access for EASY MAINTENANCE. Special spindle mounting, DESIGNED TO REDUCE WEAR.

Positive chain drive from gear box to spindle PREVENTS SLIPPAGE. All models use STANDARD AMERICAN TOOLING

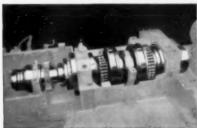
With speeds, machining accuracy, ease of tooling and operation and maintenance equal or superior to any machine in its classification, BSA Single Spindle Auto-Inatic Screw Machines offer a very definite plus value through "unit construction and replacement" of work spindles, side slides, turrets and gear boxes.

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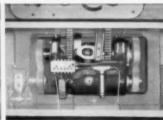
Shipment of replacement parts are speeded to you from National Acme, in Cleveland. Here, also, full engineering and design services as well as demonstration and service facilities, in the National Acme tradition, are available to you.

May we explain how "unit construction and replacement" can ease your production problems?

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Gear Box



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